JUN 4 1923

In Two Sections — Section One

Engineering Library

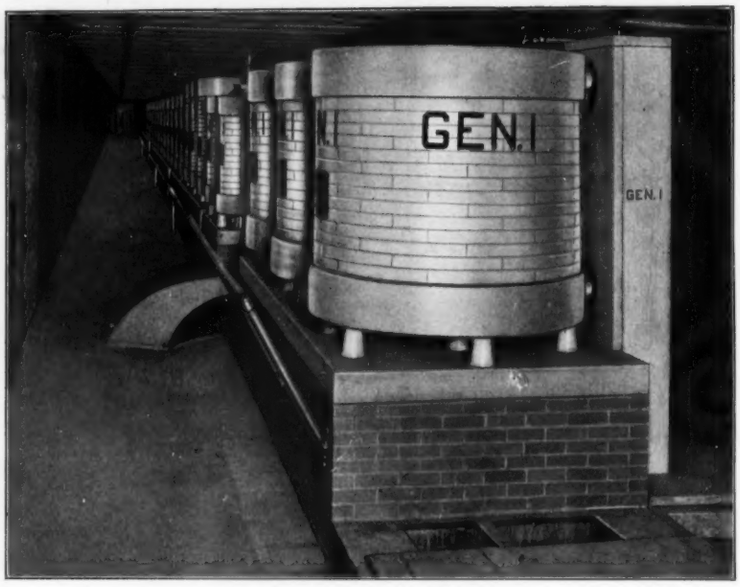
Electrical World

McGraw-Hill Company, Inc.

June 2, 1923

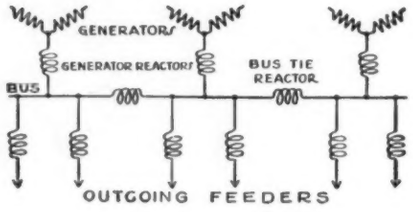
ELECTRICITY is used widest where it is appreciated most. And use begets appreciation. But if electricity with its numerous advantages and labor-saving qualities is only partly known; if there is no sense of distinction between a carbon-filament lamp and a tungsten-filament lamp, no choice between an ordinary straw broom and a vacuum cleaner; if there is no desire to progress, no longing to change from a back-breaking zinc washboard to an electric washing machine, the story of electricity has never been properly told, and by the same token electric public utilities are not enjoying a full measure of public good will and support. Once the public visualizes the utmost possibilities of electricity in the home and the insignificance of its cost, the electric public utilities will be hailed as benefactors of the community.

THERE are many ways of enlightening the public on such matters and the one great avenue of approach is through suitable and fitting publicity. No form of appeal to the individual is so universally available as the right kind of literature which will interest him and his family in their home. This means is not only effective, but cheap as well; and it is the only substitute for personal visitation and seems in fact to increase the value of the latter. No central station can afford to neglect this method of increasing its residence load and at the same time of maintaining enviable public relations.



Rows of Metropolitan Reactors in one of the New York Edison plants.

New York Edison Co. has 100% Generator Protection



Four Super Power Plants Equipped With Metropolitan Reactors

The diagram above illustrates the protection afforded Waterside Station No. 2 of the New York Edison Co., by Metropolitan Reactors. This is typical of all the New York stations.

And at Hell Gate, which all convention delegates will surely visit, every one of the 171 reactors installed is a Metropolitan Reactor. In this station alone, 140,000 kw. of generating equipment is protected by Metropolitan Reactors.

In super power plants, having installed and connected reactors from 20,000 to 40,000 kva., the reactor efficiency is almost as important as their reliability. It is often worth while to evaluate the losses in dollars and see how much would be saved by installing the most efficient—the most economical reactors.

Whatever your layout for generator or for feeder protection, check it up with what the newest and best designed stations are using.

Metropolitan Reactance Coils provide more than just maximum short circuit protection. In any distribution system there are cases where the insertion of Metropolitan Reactors into certain circuits and under normal operating conditions will cause a marked all around improvement in operation as well as in efficiency.

Other Metropolitan Products

Network Protectors
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Electrical World

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W. H. ONKEN, JR. Editor

HAROLD V. BOZELL Editor

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Publicity Versus Propaganda

PUBLIC service corporations are telling their story to the people as never before. By printed page and by word of mouth managers of utilities are sweeping away misconceptions of a generation as to the ownership, purposes, responsibilities and rewards of the people's savings devoted to the service of their communities along electrical lines. They are telling the man in the street and the woman in the home the meaning of the industry, its growth from experimental beginnings and hazardous nurturing to the present hour and the superb promise of future usefulness. And the public is responding to this policy of cards face up on table, but some still doubt, calling this work propaganda.

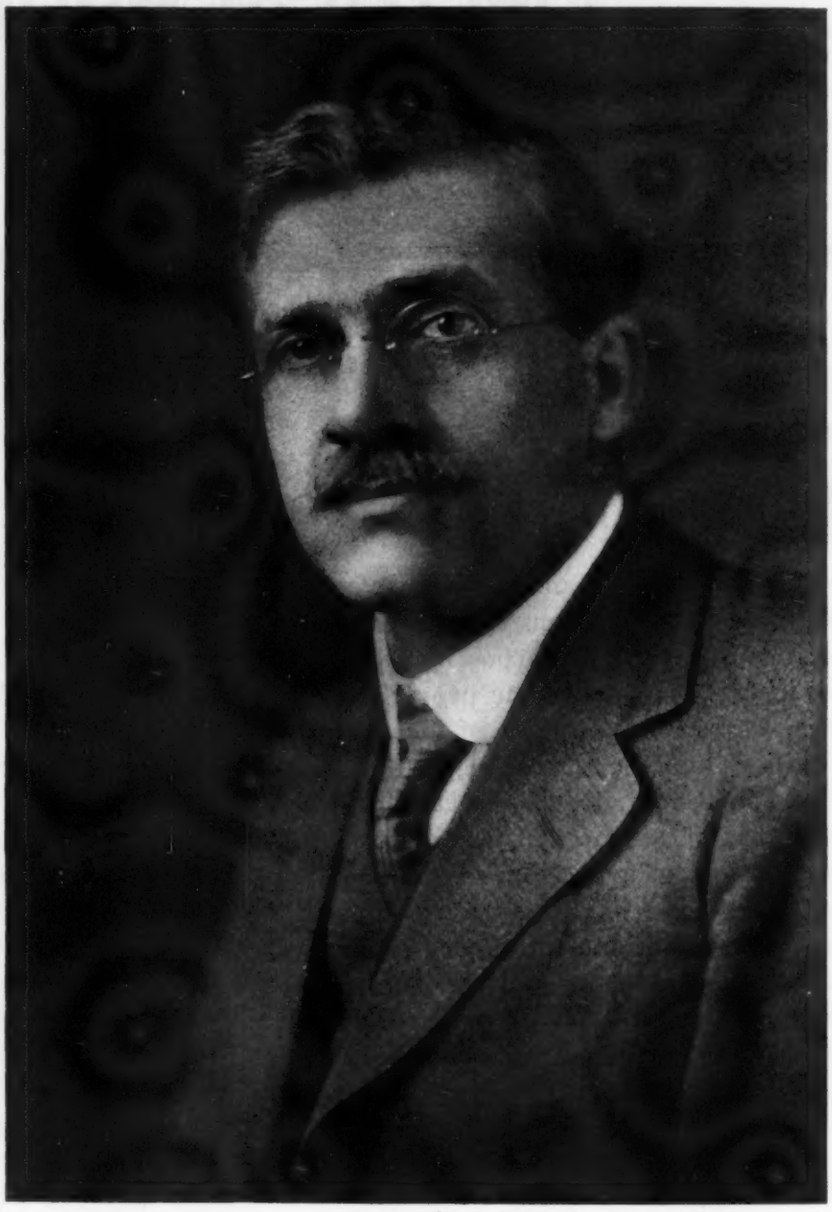
Inside the electrical family we know better. The councils of the industry are shot through and through with discussions by executives and employees in groups large and small of the problems of service. How to meet and how to anticipate the public's needs; how to become better acquainted with customers; how to reduce costs and give more and better service for a given outlay—these are the topics of committee meetings and conferences that never get into the newspapers, but which ought to yield local "copy." Honest efforts to do the day's work better comprise these programs from national conventions down, and if there is any industry striving harder to serve civilization fairly and intelligently, its name is yet to be told.

Sinister meanings are attached to the word "propaganda." The people remember some things a long time, and now and then fail to see the difference between the agency of warfare and hidden selfish purposes and the instrument of truth embodied in today's frank and adequate policy of opening an industry wide for inspection and popular information. Now there are two major requirements in utility publicity: Crystal clarity and statement 100 per cent true and a service matching such statements to the uttermost limit of human ability. Straightforward plain-English accounts of what is doing for the mutual benefit of company and people; rock-bottom elementary principles of finance and regulation; Anglo-Saxon sentences about mutual problems, all expressed in a friendly, nothing-is-being-concealed fashion — and then, officers and employees who strive mightily to live up to the implied ideals.

If the daily performance of every utility employee squares with these principles; if courtesy, honesty, loyalty and devotion are enlisted in the campaign, publicity will make friends for utilities, and the suspicion of propaganda, with its whole train of insincere implications and unwholesome reactions upon public relations, will be cast into the discard by enlightened public opinion.

Reuben B. Benjamin

A leader in rendering electrical service to the public which is both economical and entirely safe.



ELECTRICAL conveniences in the home are nowadays accepted by the public as a matter of course and without any realization of the brains and energy that have been necessary to place these things at its disposal. To the effort and ability expended in the development of convenient and safe wiring devices the extent and popularity of the whole electrical industry have, none the less, been in very large measure due, and in this work the name of Reuben B. Benjamin stands in the front rank.

Born in Fulton, N. Y., in 1869, Mr. Benjamin grew up as a farmer and rancher in New York, Illinois, Virginia and South Dakota. On the South Dakota farm he went through the great blizzards of 1887 and 1888 and developed that pertinacity and strength of character that took him to the front in later life. Leaving the farm in order to develop his mechanical bent, he went to Iowa State College at Ames and was one of the three men to whom that college first granted a degree in electrical engineering.

After graduation in 1892 Mr. Benjamin went to Chicago and worked as an electrician. While he was employed by the Commonwealth Edison Company he invented the wireless cluster, a device which perfected and revolutionized the lighting fixture business and practices of that day and made his business successful. Once launched in business, he was successful from the start and the basement shop was succeeded by larger ones until in 1910 the company moved to its present commodious quarters.

The fertility of Mr. Benjamin's brain is shown by the fact that, in addition to the wireless cluster, he has been the inventor of the swivel plug, the "Benco" socket, "Benox" interchangeable devices, two-way plugs, many designs of industrial lighting equipment, safety lighting for oil refineries and places where gases or explosive dusts are present, besides hundreds of wiring improvements, many of which have been generally adopted. He is also a collaborator in the development of "Elexits." In his efforts to promote safety he has co-operated with the National Board of Fire Underwriters, the Underwriters' Laboratories, the National Safety Council and other bodies. He has been a hard-working member of the N. E. L. A. and other electrical societies.

Editorial Comment

Electrical World, June 2, 1923

Volume 81 Number 22

Simplifying and Interpreting Electric Rate Schedules

RATES for electric service have long provided a subject for discussion within the industry and for negotiation with authorities. They have frequently confused customers and at times have proved a serious bone of contention. At best the subject has its complexities, and methods to simplify and interpret are constantly sought.

The average customer is fully willing that the electric company be allowed a fair rate. But in acknowledging the electric rate as "fair" he is likely to have in mind that it is "fairly" understandable as well as "fairly" reasonable. Complicated rate schedules may find justification in accounting theory, but they usually result in added accounting costs as well as added confusion with the customer. The simpler the rate itself the better. However, the lay public has seen enough graphical representation in ordinary literature to grasp relations indicated by a straight line; so that any means devised to represent rate schedules by straight-line plots to that extent permit the introduction of what are probably more equitable if more complicated rates.

Elsewhere in this issue H. E. Eisenmenger adds to his already well-known contributions to the subject by outlining in a simple manner, free from abstruse mathematics, how this reduction of complex rates to straight lines can be made. He also shows the benefits that are derivable from this practice in analyzing existing rate schedules, projecting new ones, computing accounts for billing purposes and explaining the rate to a customer in doubt.

Seventy-Million-Dollar Opportunity— Does Merchandising Effort Pay?

IT WAS estimated by *Electrical Merchandising* at the beginning of the year that some twelve and a quarter million electrical appliances would be sold during 1923 to the households of America. This meant a promise of a total sale of electrical merchandise by central-station companies, dealers, contractors and other retailers aggregating over $282,000,000; and from the use of this additional equipment in the home would come a new source of annual revenue to the public utility of $83,000,000. To such proportions has the business in electrical merchandise in this country grown.

These figures represent only the estimated ordinary growth of the business that is coming based on merchandising activities on the scale of the past two or three years. That is the ordinary expected business, the regular goods sold in the regular way. It is a little more business than was done last year, a little less than will be done next year, if history repeats itself. But it is worth while considering—just to dream a dream—what might happen if a little extra effort were applied—if the industry sold six fans, six cleaners, six irons, six of everything instead of five. No one knows, of course, exactly what it would mean—there are not sufficiently accurate data. But on page 1285 of this issue appears a tabulation of estimated sales of the various domestic appliances this year, according to normal expectation, and the energy revenue to be derived therefrom, together with an analysis of what a 20 per cent increase in these figures would be worth to the industry. The estimate is at least worth discussing, and if even approximately correct, it shows roughly a seventy-million-dollar opportunity for the price of a little added effort and a little better planning.

The attention of the entire electrical industry will be focused next week on the annual convention of the National Electric Light Association in New York. There will be much discussion of what the central-station company should do to sell more appliances. Here is one measure of the value of efforts in this direction.

Nation-Wide Interconnected Superpower Survey

A PLAN of electric generation and transmission with proportions truly great has been worked out by Frank G. Baum, an engineer of wide experience in long-distance hydro-electric transmission. His scheme is outlined briefly in this issue. It involves the utilization of the country's vast water-power resources in a comprehensive interconnected system without jeopardizing the investment already made in large modern steam electric generating stations. He divides the country into twelve regional electric power districts, and if the zones are larger than any heretofore contemplated, it is because Mr. Baum is looking far into the future and after much study has mapped a logical system whose advantages loom greater the more it is studied. There is about it nothing visionary or provincial. It is national in scope, contemplates the transmission of large blocks of power, and is based on experience and surveys in the field. True, some of the transmission distances are quite long, but length of transmission is not generally a determining consideration; dependable economic power supply, good load factor and a large stable market are often more important.

Fortunately, no work of such a magnitude has yet been undertaken, so that there is nothing to be undone. The proposed superpower transmission system of energy trunk lines is merely superimposed on what is already in existence. A cursory examination of the regional zones in the East, for instance, indicates that the scheme is instantly applicable to that section. There is a million and a half hydro-electric horsepower available in Tennessee and half as much in West Virginia within easy transmission distance of the great industrial section in the Ohio Valley. The government's survey has shown the necessity of a superpower system along the Atlantic seaboard from Boston to Washington, and water-power development on a grand scale is the present topic of discussion in engineering and political circles in the Middle Atlantic States. We mention this merely to show the timeliness of Mr. Baum's

scheme and to indicate its practical value. The nation's resources of water power, coal, oil, and gas are known; so are the great power markets. What Mr. Baum has done is to fit one into the other in a masterly fashion, thus indicating the lines along which progress will march. His is a very valuable and far-sighted contribution to the art and economics of electric power transmission and will well repay close study and application.

A Word About Artificial Lightning

THE brilliant and sensational results obtained with "artificial lightning," reported in the May 19 issue by F. W. Peek, Jr., bring to mind some of the characteristics of the natural phenomenon and their relation to experimental results of this sort. All through the history of power transmission it has turned out that as working voltages went up and the insulation of the lines rose with them there has been on the whole less and less trouble from lightning. In other words, the line insulation has been sufficient to take care of a great many disturbances charged up to lightning. Of course, the fact is well known that only a very small minority of the so-called lightning strokes on the line are at all of the nature of direct hits. Most of them are induced discharges of greater or less severity, sometimes giving rise to savage surge effects on the system. The supervoltages may amount to several times the nominal line voltage, but save in direct strokes do not reach any astonishing figures. As Mr. Peek shows, there is not much above 400,000 volts that occurs in actual practice.

The experimental investigation of lightning discharges has risen to high importance since the initiation of the various projects for superpower lines at working voltages exceeding 200,000. In particular, the effect of lightning discharges on the distribution of stresses over insulating strings is a very vital factor in design. Now, the beauty of the apparatus devised by Mr. Peek in its later stages of development is that a pressure of 2,000,000 volts can be momentarily applied to the line, or any voltage up to that astounding figure. The general method of obtaining these prodigious differences of potential is the charging of a static condenser of great capacity to the necessary voltage and then arranging for its discharge over, for instance, an insulator string so as to simulate anything which nature can show.

Lightning discharges are for the most part known to be of enormously steep wave front, generally nonoscillatory as regards any material part of the energy. By discharging a condenser of adequate size through known inductance and resistance it is obvious that almost any amount of damping or lack of it can be obtained on the wave front, giving approximately any wave shape that may be desired. Incidentally, the rate at which energy is turned loose on the system is enormously great as compared with any rate of output of man's devising, unless possibly the firing of a great coast-defense gun. Therefore with an almost indefinitely large amount of energy as reckoned in kilowatts available, with a wave shape which can be regulated with a good deal of precision, it becomes possible to try out in advance all the critical things which might be supposed to present the practical problems of insulation for superpower lines. The mere feat of getting the apparatus for doing this work is a memorable one. The usefulness which may be attained in the transmission work of the next half century is beyond present measure.

Railroad Electrification and Power Supply

EVENTUALLY the railroads of this country will be electrically operated. Of that there is no doubt. Meanwhile, however, old-line steam-railroad men are doing all that is possible to prolong the present system by improving the efficiency of locomotives, lowering grades, eliminating curves, and so forth. This, of course, is praiseworthy, but it will not ward off the inevitable. It is well, however, for electrical engineers to recognize the situation and to visualize the immensity of the inertia to be overcome. Two weeks ago Julius Kruttschnitt, in an address before the International Railway Fuel Association, stressed the need of greater efficiency in the use of fuel by the railroads and indicated that thereby a reduction of 13 per cent of expense is possible. For the future, Mr. Kruttschnitt says, the hope for conserving fuel lies in (1) substituting hydroelectric energy for steam, (2) substituting steam turbines or compound condensing engines for simple engines, (3) use of a cheap high-gravity fuel, (4) reduction in weight of Diesel engines sufficiently to permit of their use as locomotive engines, and (5) development of a satisfactory variable-speed transmission gear for coupling the Diesel engine to the driving wheels of the locomotive.

In that he chose electrification first Mr. Kruttschnitt did well, but that electrification depends on water power does not follow. Electricity can be produced in steam generating stations just as cheaply in many instances as from water power, and under certain conditions of load factor cheaper. What the railroads need is not conviction on the necessity of greater water-power development, but conversion to electrification. When this is accomplished they will find that the electric light and power industry is not only prepared to supply all the energy they may need, but at a price that no railroad can afford to ignore. The railroads need never lack for electricity.

In this connection the last two recommendations of Mr. Kruttschnitt may be commended to the thoughtful consideration of the manufacturers of electric railroad equipment. If Diesel engines ever become available for locomotives, electrification will be set back a generation and the manufacturers of electrical equipment will have only themselves to blame. It will be a sad day for them if the "battle of the systems" shall lead to such an outcome.

Electrical Heat Treatment Assuming Greater Prominence

RENEWED activity in the use of electric furnaces in all sorts of metallurgical operations has followed the resumption of business activity, and it may be well once more to indicate the virtues and limitations of their application in the light of present practices, problems and equipment.

Given the requirements of heat treatment for whatever purpose, two fundamental questions at once arise. First, what will be the over-all cost? Second, is electrical heat worth any more on account of any special bearing on operating and utilization?

As regards the first question, it is fairly easy to determine the necessary B.t.u. to supply the quantity of heat required for delivery to the articles in process. The basic quantities are the unit cost of heat used and the efficiency with which the energy thus provided can be delivered to the work. These calculations are inde-

pendent of the source of heat used, but the electric heat calculations are made more readily and accurately because of the difficulty in determining data when using gas, liquid or solid fuels. Speaking in general terms, the transformation of energy in fuel to heat delivered by furnace resistors is on a par with the thermal efficiency of the best heat engines, and when comparison is made with furnaces using direct heat the real efficiency is about a stand-off. On a thermal efficiency basis, therefore, there is no real reason for deciding at the start that electric heat is unnecessarily expensive.

As regards first cost of installation, many variables occur which make it difficult to fix upon a basis of comparison. The insulation material and quantity of insulation used is generally greater on the electric than on the directly heated furnace, but, on the other hand, when floor space, fuel storage capacity and other auxiliary installation details are considered, again a stand-off is generally reached on cost comparisons.

On the second count of production efficiency and convenience a long line of experience with furnaces for almost every sort of use shows that electric heat possesses superior merits from the standpoint of ease of application and control, flexibility in furnace location, accuracy of measurements, speed of production and uniform quality of product. In many industrial processes the fact that electrical heat can be applied uniformly and controlled accurately has been the deciding factor in its adoption, to say nothing of the advantages that come from the ability to work electric heating in vacuo or in any sort of neutral atmosphere that may be needed. Furthermore, the indirect saving obtained by having all process material turned out with exactly the same quality has been an important reason for the adoption of the electric furnace.

There is still much to be done in electric heating—many other applications to steel treatment would occur if the slightly oxidizing atmosphere in the electric furnace could be eliminated. Radiant and resistance types of heating elements and also furnace insulation are not yet perfected, but every indication points to a still greater increase in the load of electric heat-treating furnaces on the lines of the big central stations.

Circuit Breakers and Other Switchgear

NOW and again calls come for radical improvements in circuit breakers, improvements that will lessen the cost and space demanded, improve the efficiency of the apparatus and the quality of the break, and in general relieve the art from what one may refer to as the hypertrophy of the switchboard. Now, by and large, the apparatus available from standard makers is of good operative quality. It meets the technical requirements on the whole remarkably well and almost daily advances are recorded; but any one who studies the ensemble of the circuit breakers and other switchgear in a modern station comes to a sudden realization that the tail is wagging the dog, that distribution practice has been built up along lines which have forced the switchboard into undue prominence.

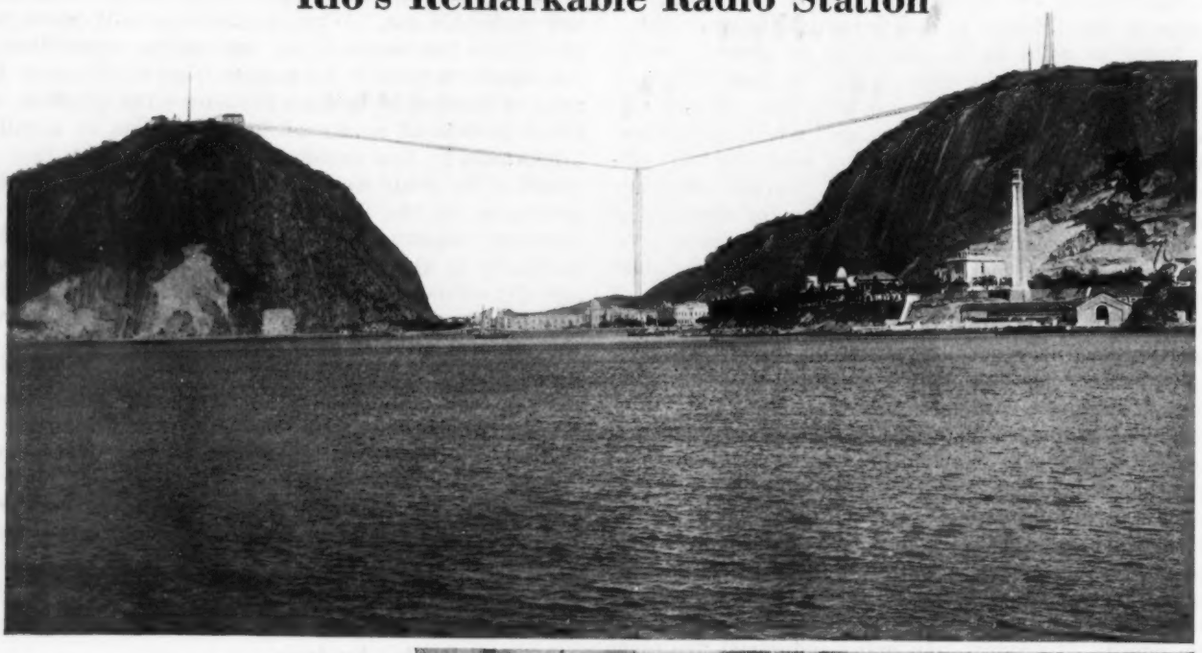
While minor improvements in material and design will undoubtedly be made and will perhaps aid here and there in reducing the absurd overgrowth, anything of sweeping importance in increasing the effectiveness and cutting down the formidable expense of the switchboard must come from new conceptions of efficiency in distribution methods rather than from evolution along lines now well laid out. What would happen if there were given into the hands of an engineering committee not too closely devoted to the exploitation of things as they are the problem of laying out *de novo* the complete electrical system of a city of half a million or a million inhabitants? One could feel very confident that the result of its study would be startling to those who have grown up in the regular evolutionary course of conventional construction. Of course, no such blessed opportunity is likely to fall into the hands of any one in our day—this whole question of relatively inexpensive and efficient switchgear is inextricably bound up with the general problems of distribution. Most of our great systems in this country and elsewhere have just grown, each step being a forward one, but hampered by the whole history of the enterprise, financial and technical. In the matter of switchgear, just as elsewhere, real advance is likely to be slow, but some day there will be an opportunity to break away from tradition and make headway along new lines of progress.

High-Voltage Insulation Still Baffles Analysis

ONE of the oldest experimental problems in the field of electrical engineering is that of the nature of the processes involved in high-voltage insulation. The question is important from both the practical and the purely scientific standpoint. It is a problem which is receiving increasing attention, and there is constant evidence that trained investigators are being attracted more and more to the wide variety of problems offered in this field. Recent evidence of this is the receipt in this country of German publications of the work of Dr. K. W. Wagner, who, it will be recalled, addressed the A. I. E. E. at the Chicago meeting in the spring of last year. Dr. Wagner's paper emphasized the importance of the influence of temperature on insulation, and he suggested that the process of breakdown is largely if not entirely due to the increasing conductivity of insulation caused by temperature rise. At about the same time there appeared in the ELECTRICAL WORLD an account of the experiments of Steinmetz and Hayden leading to very much the same conclusions, although the experiments were quite different in character.

These two sets of experiments do not constitute the first suggestion of the importance of temperature as a factor in the processes leading up to the failure of high-voltage insulation. For a long time the occurrence of hot spots in cables has been noted and has led to the realization that insulation failure does not, in accordance with early ideas, occur as a result of abrupt or disruptive puncture. The important phase of experiments of this character lies, therefore, not so much in the suggestion of a new theory of breakdown as in the new methods that are opened for the further study of the nature of the processes of insulation. The subdivided electrode of Steinmetz and Hayden, on the one hand, and the high-resistance electrode of Wagner, on the other, both offer suggestions for new avenues of study of the behavior of limited regions of the dielectric or insulator. Neither method has been perfected, but each offers good promise of more exact study of this extremely important problem.

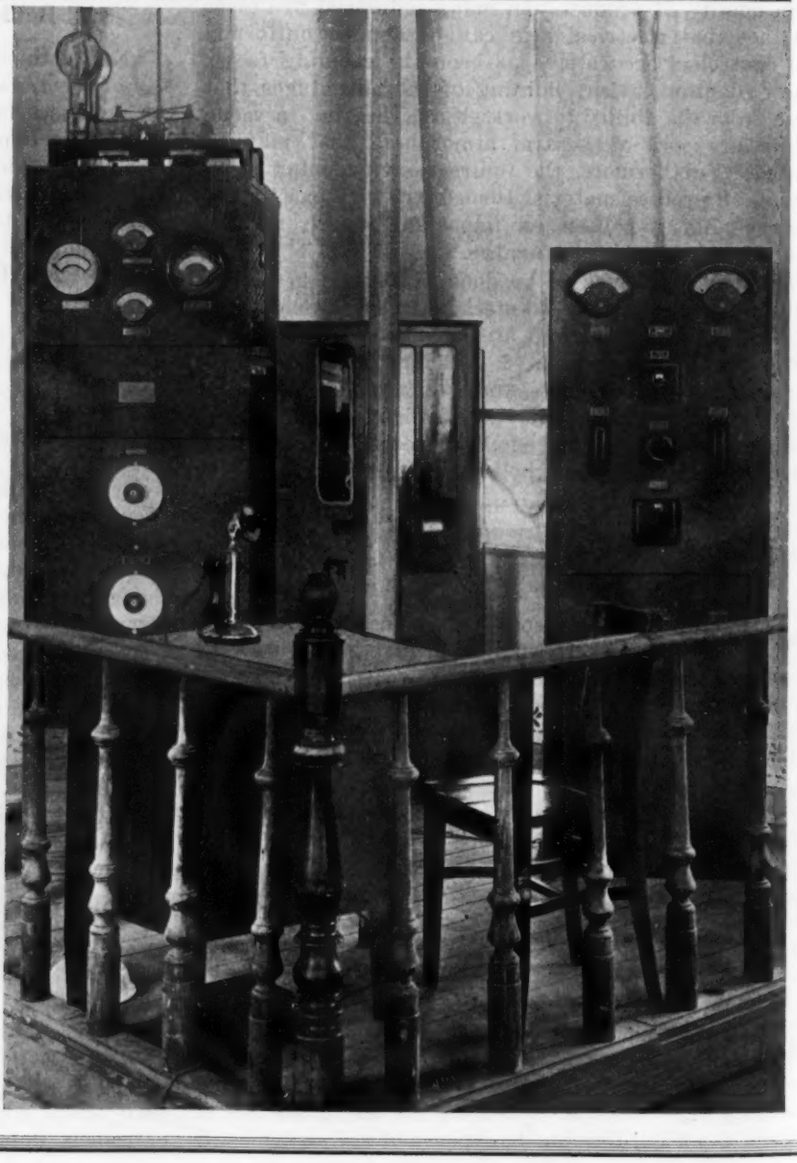
Rio's Remarkable Radio Station



TO BE heard 8,000 miles is the remarkable record of the radio broadcasting station SPE erected by the International Western Electric Company at the Brazilian Centennial Exposition at Rio de Janeiro.

The antenna, which contributes considerably to the exceptional efficiency of this transmitter, is of a very unusual type. It is a six-wire cage antenna, 500 ft. long, and is suspended from a cable strung between the tops of two mountains, Urca and Babylonia, near the famous Sugar Loaf Mountain. Musical programs were broadcast from this station and were received on a Western Electric 3-A radio receiver and amplified for the enjoyment of thousands of visitors at the exposition by the Western Electric Public Address System.

On Feb. 2 an official demonstration was held, at which a speech delivered by Dr. Sampaio Vidao, Secretary of Agriculture, and military band music were transmitted from Rio and received at São Paulo. Here the Public Address System, installed in a theater, amplified the Rio program for a large audience, in which were the Mayor of São Paulo and many other notables.



Automatic Plants Aid Western Water-Power Development

Nine Semi-Automatic Generating Plants, with a Total Rating of 14,655 Kw., Are Now in Operation on Southern California Edison System—Operating Costs Are Reduced Approximately 45 per Cent

By E. R. STAUFFACHER* and GUSTAF CLINWALD†
Southern California Edison Company

WHILE attention has been focused on such developments as Big Creek, Pit River, Kern River and other large projects in California because of their spectacular nature, yet notice has not been lacking of the economical operation of some of the older and smaller hydro-electric plants by the use of automatic or semi-automatic control. Because of the greater savings in operating costs many small plants have been changed over from manual to semi-automatic operation and others which will be automatic or semi-automatic are either under construction or planned. There are now in operation in California about fifteen installations of this type with a total capacity of nearly 20,000 kw. It is safe to say that all of these plants would be economically impracticable if it were necessary to employ manual control. Automatic control has been confined so far almost entirely to the smaller plants which were the pioneers of the modern power plants of today. These small plants, with their high operating expense, cannot compete with the lower production costs of the larger plants and would have to be discarded if it were not for the economy brought about by automatic operation. Another factor in their development has been the problem of keeping competent operators. Present-day operators are rapidly assuming an attitude of independence and an air of indifference toward their work. They expect modern city conveniences and even with the best of accommodations do not always show the proper appreciation. With the present high labor turnover it is only logical that automatic apparatus should be meeting with favor in the small and remote hydro-electric plants of the West.

The automatic generating plant is comparatively new, and in the earlier plants most of the apparatus of necessity had to be home-made, particularly that for proper water control where storage capacity was very limited or there was none at all. The manufacturers are rapidly meeting this situation, and it is now possible to duplicate every operation of manual control, even to observing the operating conditions of an automatic station at some distant point. A system of supervisory control has been worked out by means of which over a single pair of wires it is possible to listen in on a distant station and determine the position of circuit breakers, water level, load on the station, hot bearings, etc. The present tendency in the design of these plants is toward the use of induction generators, although most of the plants now in operation are equipped with synchronous generators. The present economic limit of the automatic generating plant seems to be about 5,000 kw., or a limitation to plants where operating costs are relatively high in proportion to fixed charges. In the larger plants with high load factor and relatively

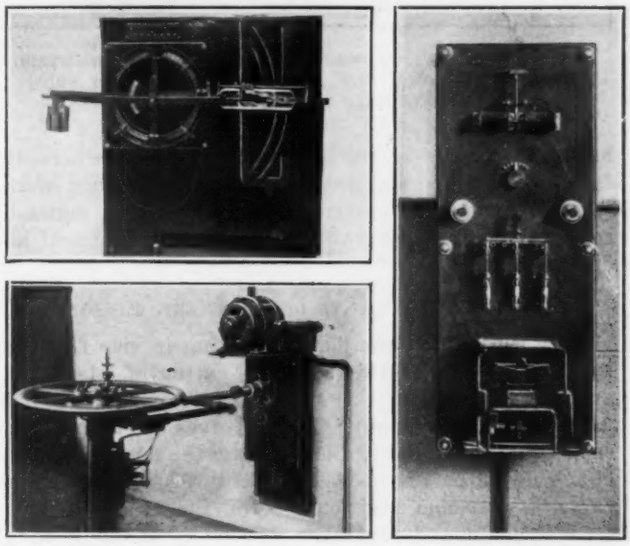


FIG. 1—ESSENTIAL ELEMENTS OF WATER-CONTROL SYSTEM FOR SEMI-AUTOMATIC GENERATING PLANTS
Upper Left—Float switch at forebay. Lower Left—Motor controlling turbine nozzle. Right—Balanced relay and motor switch.

*Protection engineer. †Assistant superintendent of generation.

TABLE I—DATA ON HYDRO-ELECTRIC PLANTS OF SOUTHERN CALIFORNIA EDISON COMPANY CHANGED FROM MANUAL TO SEMI-AUTOMATIC OPERATION

Plant	Waterwheel				Total Generating Capacity (Kw.)	Static Head (Ft.)	Storage Capacity Additional to Forebay
	Number	Rated Hp.	Size, In.	Make and Type			
Fontana (leased)	2	1,200	..	Pelton-tangential	2,000	760	None
Kaweah No. 2	1	2,250	28	Pelton–Francis	1,700	360	None
		1,000	39	Pelton-Victor turbine			
Kaweah No. 3	2	3,000	72	Pelton-Doble tangential	3,900	750	None
Lytle Creek	2	400	42	Pelton-tangential	585	483	None
Mill Creek No. 1	3	250	30	Pelton-tangential	670	510	7 acre-ft.
Santa Ana R. No 2	2	800	..	Doble-tangential	1,200	305	Bear Valley Res.
Santa Ana R. No. 3	1	2,000	72	Doble-tangential	1,550	352	Bear Valley Res.
Sierra	2	400	..	Pelton-tangential	750	628	None
Tule River	2	1,800	40	Doble-tangential	2,300	1,150	None
Total	..	.....	..		14,655	5,298	

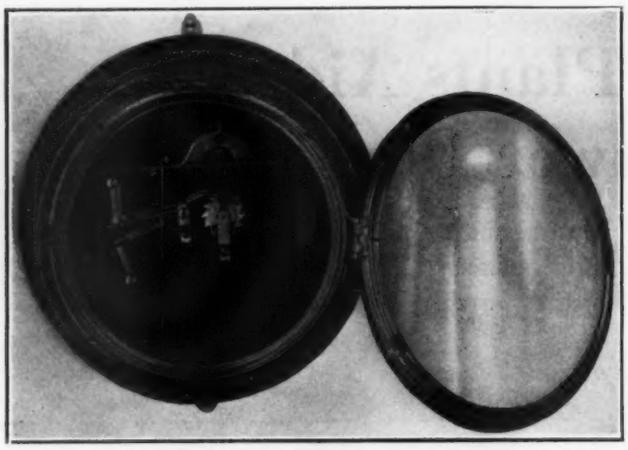


FIG. 2—TIME SWITCH WHICH ENERGIZES WATER-CONTROL MECHANISM FOR A FEW SECONDS AT PERIODS OF FROM TWO AND ONE-HALF MINUTES TO FIVE MINUTES

heavy fixed charges per kilowatt-hour, and where the capacity of the plant is such that a shutdown would seriously affect the system it is feeding into, manually controlled plants generally prove more economical and desirable.

AUTOMATIC PLANTS OF SOUTHERN EDISON

Nine semi-automatic plants, varying in size from 585 kw. to 3,900 kw. and with a total rating of 14,655 kw., are in operation on the system of the Southern California Edison Company. Table I gives the number and capacity of the units in these plants, the operating head, etc. Full automatic operation was not considered necessary, because one man must be on the premises to act as watchman and caretaker and he is available at all times to start up the plant in case of a shutdown from any cause. The problem of changing to semi-automatic operation was primarily one of water control as the plants have little or no storage. Furthermore, in southern California, where water from small mountain streams is used for irrigation, it is necessary that the hydraulic plants be so operated that under no circumstances will water be spilled at the forebay and thereby wasted.

To meet these conditions special water-control equipment has been developed. In case of high water in the forebay the generator will automatically pick up more load, and in case of low water the nozzle on the waterwheel will be slightly closed so that there will be no danger of lowering the water in the forebay to the extent of allowing air to be trapped in the penstock or pressure pipe. In some of the older plants this is accomplished by means of current-balanced relays wired in the nature of a Wheatstone bridge so arranged that fluctuations of the water in the forebay cut in and out suitably arranged resistances. This causes relays to operate at the power house and open the waterwheel nozzle if the water in the forebay is high and close it if the water is low.

The specially designed water-control equipment used at the Sierra plant, the last one to be converted from manual to semi-automatic operation, is shown in Fig. 1, and the wiring diagram in Fig. 3. This newly designed equipment is operating very satisfactorily and will probably be made standard water-control equipment on the Edison system. At this particular station there are two units of 300 kva. each, operating under a head of approximately 700 ft. The storage is very small and the conditions of water control are severe. Roughly, the system is comprised of three essential parts—a motor with limit switch and gearing mounted at the needle valve, a slate panel on which are mounted the necessary relays, etc., and a specially designed float switch installed at the forebay.

To obtain the desired regulation the periods between the operation of the needle valve motor and the duration of an operating period should be roughly a function of the distance between the actual and the desired water level. The motor must move the needle valve in proper relation to the water level, and the action of the needle should be discontinued at any point, provided the water is moving toward the proper level. It will be seen from Fig. 3 that there are two circuits, one comprising a coil of the balanced relay *BR* and the reactance *BI*, and the other the remaining coil of the relay *BR* and the reactance *R*. The core of the reactance *BI* may be moved by means of a knurled nut to facilitate close balancing, and the core of reactance *R* is actuated by the float mechanism. These balanced circuits are energized every two and one-half or five

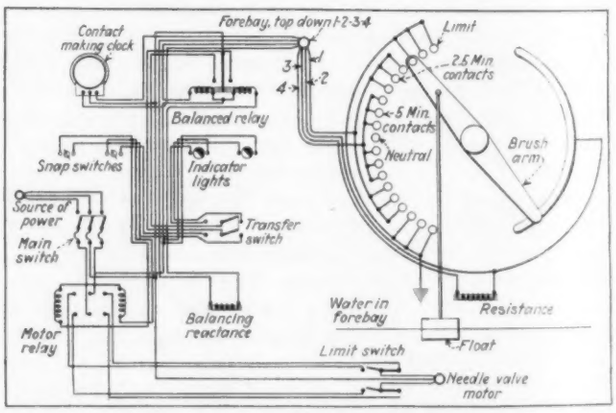


FIG. 3—CONNECTIONS OF ELECTRICAL EQUIPMENT AT FOREBAY AND POWER HOUSE FOR WATER-CONTROL MECHANISM IN SEMI-AUTOMATIC GENERATING PLANTS

minutes by the contact-making clock shown in Fig. 2, or continuously from ground as determined by the position of the float-actuated brush arm *BA*. If upon being energized the circuits are unbalanced by the position of the core in the coil *R*, then the balanced relay *BR* closes its contacts to the left or right and operates the needle valve motor, the motor relay and the limit switch, or gives a visible signal by means of indicating lights as determined by the position of the transfer switch. The

TABLE II—COMPARATIVE ANNUAL OPERATING COSTS OF MANUAL AND SEMI-AUTOMATIC GENERATING STATIONS

Plant	Estimated Cost 1922			Actual Cost, 1922			Annual Saving
	Labor (Chief and Three Operators)	Maintenance (Three-year Average)	Total	Labor	Maintenance	Total	
Santa Ana No. 3	$5,400.00	$136.58	$5,536.58	$2,369.10	$23.76	$2,392.86	$3,143.72
Lytle Creek	5,310.00	121.57	5,431.57	2,123.50	6.68	2,130.18	3,301.39
Santa Ana No. 2	5,400.00	195.21	5,595.21	1,902.05	132.57	2,034.62	3,560.59
Mill Creek No. 1	5,340.00	188.31	5,528.31	1,972.29	33.87	2,006.16	3,522.15

mechanism for controlling the movement of the core in reactance *R* is shown in the upper left hand picture in Fig. 1.

Where a plant has more than one generating unit the regulating is done on only one waterwheel and the others are operated at continuous load.

PROTECTION AGAINST TROUBLES

Equipment is provided to protect against troubles developing inside the power house or on the transmission lines. This equipment is arranged so that in case of a short circuit the armature switch is kicked out, which in turn kicks out the field circuit breaker, thus causing the automatic governor trip to operate. Bearing thermostats are provided at the main waterwheel, generator and exciter bearings, and the thermostats and circuit breakers are connected with an annunciator so that the attendant can easily locate the trouble in case of a hot bearing or a switch kicking out. In case of a complete shutdown of a plant it is started up manually and put back on the line by the caretaker. It is felt that the complication necessary to accomplish this result would not be justified in view of the fact that there must be one man on the premises at all times for other reasons.

The equipping of these small plants for semi-automatic operation on the system of the Southern California Edison Company has resulted in marked savings in operating costs, as shown by Table II. Not only have operating costs been reduced, but it has been found that maintenance costs are actually less owing to the smaller use of oil and waste. On the whole, the plants have given more satisfactory operation than when under manual control.

Fuel Economy and Production Expenses

Data Are Given for Forty-five Coal Burning Plants Ranging from 10,000 Kw. to 122,000 Kw.—First Part of Analysis Which Will Be Presented in Installments

By ALLEN M. PERRY
Engineering Editor ELECTRICAL WORLD

THE many expressions of appreciation of the operating data given in the July 15, 1922, issue of this periodical and the widespread requests for the article led the ELECTRICAL WORLD to solicit similar information from operating companies all over the United States. The response to its inquiries was so much beyond expectations that the data received willl be published in installments as they are compiled and checked, instead of waiting until the entire mass of material is ready for publication. The figures refer to the twelve months ended July 1, 1922.

If the operating conditions are carefully studied and the data properly interpreted, they should be helpful in showing the results that may be obtained by other companies operating under similar conditions. However, the chief interest of the information lies in showing the effect which concentration of power generation, extent of plant utilization, characteristics of coal, price of fuel and labor, etc., have on fuel economy and operating and maintenance expenses. Every engineer recognizes that the costs which are recorded are also affected by plant conditions (modernity, type of equipment, upkeep, etc.), plant management and the human factor involved in labor, but many of these factors are intangible and cannot be incorporated in a table of this kind. Neither can a large expenditure for maintenance be properly spread over a long period in the way it should be. Despite the many factors which influence operating economy and production expenses, it is interesting to observe how closely the results obtained in plants of similar size follow the plant factor and coal characteristics.

To make possible a more intelligent interpretation and study of results several changes were made in the form of this table as compared with the one printed ten months ago. For example, it was considered necessary to rate all stations in the same manner; hence the total installed rating as indicated by nameplates is given. Allowance has not been made for overload capacity, and reserve equipment has been included. Neither has the rating been reduced where there is insufficient boiler capacity, but each reader can make his own interpretation if he will compare the ratings with the figures given in the last two columns.

Last year load factor was given instead of plant factor (net output in kw.-hr. $\div$ installed kw. $\times$ 8,760), but it is not believed that load factor has as much effect on performance as plant factor, or the extent to which the plant is utilized. The load factor can, however, be easily calculated by any reader who desires to know it.

In all cases it was requested that the amount of fuel burned be expressed in short tons to avoid confusion which arose last year in determining whether the fuel consumption was submitted in short or long tons. The price of fuel per ton was obtained this year so that readers who are studiously inclined may ascertain the plant value of coal containing different amounts of ash and heat content.

The wages paid for labor might also be interesting, but to be of any use it would also be necessary to show how this labor is distributed.

Maintenance expenses have been further subdivided this year into building and structures, boiler plant, prime movers and auxiliaries, generators and electrical equipment, and miscellaneous.

An analysis of the figures will show the value of concentrating power generation and operating at the highest plant factor, although it is surprising to see how one of the smaller plants (No. 57), operating at low plant factor, is holding down its production expenses. The remarkably low total production expense of this plant is due to the fact that the plant is operating with a much smaller force than it would require were

Operating Economy and Production Expenses of Forty-five Coal-Burning Generating Stations (10,000-122,000 Kw.)

Station	Installed Generator Rating (Kw.)	Annual Plant Factor, Per Cent	Annual Output (Kw.-hr.)	Peak Load (Kw.)	Annual Fuel Consumption (Short Tons)	Average Btus. Per Lb.	Average Ash, Per Cent	Price of Fuel Delivered (Per Ton)	Pounds Fuel Per Kw.-hr.	Btus. per Kw.-hr.	Unit Production Expenses (cents per kw.-hr. delivered from switchboard)										Grand Total	Energy Consumed in Station, Included	Boiler Equipment		Generator Equipment	
											Operating Expense				Maintenance Expense								No.	Hp.	No.	Kw.
											Fuel	Wages and Superintendence	Water, Lubrication and Supplies	Total	Building and Structures	Boiler Plant	Prime Movers and Auxiliaries	Generators and Electrical Equipment	Miscellaneous	Total						
289	122,000	18.6	198,786,421	62,900	223,177	11,019	14.4	$3.96	2.24	22,670	0.442	0.102	0.056	0.601	0.004	0.043	0.010	0.003	0.001	0.060	0.661	.....	32—	518	3—	20,000
																							24—	558	4—	12,000
																									1—	10,000
																									1—	4,000
18	100,000	34.7	303,670,040	76,000	228,701	13,000	11.0	6.82	1.51	19,650	0.522	0.059	0.013	0.594	0.002	0.011	0.012	0.006	.....	0.031	0.625	No	10—	1,263	4—	31,250*
					See footnote[1]																		4—	1,384		
64	95,000	8.96	74,580,700	58,000	81,127	13,000	10.4	5.52	2.18	28,260	0.597	0.141	0.041	0.779	0.019	0.072	0.017	0.004	0.004	0.115	0.894	Yes	11—	1,140	3—	20,000
		See footnote[2]																					with 9,400 sq. ft. economizers		1—	35,000
220	87,000	31.8	242,457,293	65,000	223,106	14,300	6.0	6.30	1.84	26,300	0.587	0.042	0.013	0.641	0.004	0.016	0.016	0.009	0.001	0.046	0.687	.....	20—	600	3—	9,000*
																							7—	1,000	2—	5,000*
																							4—	525	2—	15,000*
																							1—	1,000	1—	20,000*
7	72,000	16.9	106,641,022	40,300	95,694	14,698	5.9	5.76	1.80	26,400	0.618	0.092	0.020	0.730	0.006	0.047	0.028	0.028	0.008	0.089	0.819	.....	16—	600	3—	4,000
																							8—	755	1—	10,000
																									2—	15,000
																									1—	20,000
115	48,000	23.2	181,657,165	41,700	113,772	13,000	14.0	4.68		25,800	0.544	0.150	0.024	0.718	.....	.....	.....	.....	.....	0.123	0.841	No	14—	900	2—	15,000
					See footnote[3]																				1—	5,000
					374,631	18,000		1.22																	1—	4,000
					bbl. oil			per bbl.																	3—	2,500
																									1—	1,500†
53	60,000	58.2	305,867,600	62,000	243,089	13,150	10.1	3.96	1.59	20,900	0.330	0.066	0.034	0.430	0.007	0.022	0.007	0.003	0.001	0.040	0.470	Yes	7—	2,087	1—	60,000
84	60,000	40.8	214,351,541	48,400	212,415	10,733	.....	4.86	1.98	21,250	0.537	0.059	0.022	0.618	0.001	0.020	0.001	0.005	0.008	0.034	0.652	.....	8—	1,388	3—	20,000
12	55,000	7.6	36,664,720	24,500	43,493	13,650	9.0	8.59	2.37	32,350	1.019	0.222	0.039	1.280	0.027	0.092	0.011	0.018	0.011	0.159	1.439	.....	12—	700	1—	25,000*
																							See footnote[4]		1—	20,000*
																									2—	5,000*
186	53,000	28.7	133,200,300	28,200	149,171	10,457	16.1	5.30	2.24	23,400	0.596	0.052	0.018	0.666	0.007	0.048	0.006	0.006	0.005	0.071	0.737	.....	7—	550	2—	3,750
																							2—	450	1—	5,000
																							8—	500	1—	4,000
																							1—	1,500	1—	1,500
																									1—	15,000
																									1—	20,000
187	50,000	57.5	217,351,608	50,650	344,414	10,120	20.0	2.20	3.17	32,105	0.340	0.091	0.047	0.478	0.018	0.072	0.049	0.032	0.045	0.216	0.694	No	8—	1,043	3—	10,000
																							6—	1,179	1—	20,000
																									See footnote[5]	
241	48,250	27.1	114,681,040	34,000	128,180	12,263	13.0	3.90	2.30	28,200	0.436	0.073	0.032	0.541	0.007	0.050	0.035	0.009	0.005	0.105	0.646	No	1—	520	2—	3,500
																							10—	512	1—	6,250
																							6—	1,000	1—	10,000
																									2—	12,500
13	45,000	36.3	143,075,400	37,500	127,221	12,770	11.3	4.56	1.78	22,720	0.443	0.050	0.026	0.519	0.002	0.043	0.028	0.004	0.001	0.078	0.597	No	6—	1,373	2—	12,500
71	44,500	15.8	61,577,400	28,115	bit. 60,129	14,270	8.1	7.34	.....	32,000	0.638	0.127	0.078	0.843	0.021	0.044	.....	0.025	0.014	0.103	0.946	.....	6—	600	1—	20,000
			See footnote[6]		anthr. 10,685	12,000	18.16	4.55															2—	700	2—	20,000*
																							6—	1,250	2—	7,800*
184	40,000	58.0	202,908,075	47,000	163,866	11,961	.....	4.94	1.61	19,200	0.394	0.067	0.008	0.469	0.002	0.034	0.003	0.002	.....	0.041	0.510	.....	8—	1,306	2—	20,000
					See footnote[7]																					
57	40,000	20.8	72,678,690	18,200	57,963	14,107	13.6	3.22	1.60	22,550	0.283	0.098	0.006	0.387	0.006	0.040	0.014	0.006	0.007	0.073	0.460	No	4—	1,425	1—	20,000
																									2—	10,000
234	37,500	30.5	100,420,900	.....	41,521	10,700	15.0	3.91	.....	.....	0.711	0.092	0.036	0.838	.....	0.038	.....	0.047	.....	0.085	0.923	Yes	32—	500	1—	2,000‡
					2,164,191,000 cu.ft. gas	.....	.....	.....	.....	.....															1—	2,000‖
					See footnote[8]																				2—	7,500
																									1—	6,000
																									1—	12,500
211	35,900	19.4	61,170,000	21,000	86,187	9,338	17.0	4.19	2.82	26,300	0.590	0.101	0.007	0.698	0.009	0.029	0.008	0.034	0.004	0.084	0.782	Yes	11—	503	1—	16,000
																							4—	577	1—	10,500
																							3—	1,003	1—	6,400
																									1—	3,000
85	33,000	34.8	99,418,700	22,900	114,547	14,500	6.8	6.10	2.30	33,350	0.703	0.111	0.012	0.827	0.001	0.022	0.016	0.008	0.0003	0.048	0.875	.....	16—	512	3—	10,000
133	30,000	24.3	26,602,855	15,700	38,465	10,921	.....	4.11	2.89	31,600	0.594	0.211	0.053	0.857	0.005	0.076	0.006	0.003	0.003	0.092	0.949	No	4—	1,345	1—	3,000
					See footnote[9]																				2—	15,000
251	24,000	22.0	32,642,600	17,000	59,685	.....	.....	4.23	3.66	.....	0.877	0.265	0.028	1.170	0.042	0.107	0.035	0.028	.....	0.212	1.382	Yes	22—	400	1—	10,000
																							2—	1,000	1—	7,500
																									1—	4,000
																									1—	2,500

202	23,700	16.0	33,136,073	11,700	55,071	14,362	7.6	89.66	1.99	28,580	0.767	0.231	0.022	1.020	0.052	0.042	0.014	0.012	0.011	0.11	1.13	.....	2— 600 2— 755	1— 6,250 1— 2,000 1— 150 1— 75 3— 500¶ 1— 675¶ 2— 300¶ 1— 35†
243	22,600	24.0	47,581,394	10,900	58,084 110,563 bbl. oil See footnote[10]	.....	.....	4.41	.....	.....	0.73	0.17	0.05	0.95	.....	.....	.....	.....	.....	0.27	1.22	.....	15 totaling 8,762	3 Corliss 4 turbines totaling 22,600
144	22,500	30.1	59,381,412	16,000	50,781	13,997	8.0	7.71	1.70	23,800	0.633	0.129	0.054	0.816	0.013	0.101	see boiler plant	0.005	0.014	0.133	0.949	.....	6— 750	1— 7,500 2— 6,250 1— 2,500
170	21,250	30.9	57,618,100	17,600	58,443	13,747	7.9	4.33	2.03	27,900	0.438	0.099	0.028	0.565	0.001	0.021	0.028	0.0004	0.007	0.058	0.623	Yes	9— 800	1— 10,000* 1— 6,250* 1— 5,000*
63	21,250 See footnote[11]	18.1	30,631,000	10,500	38,640	.....	12.0	8.51 See footnote[12]	2.52	.....	1.07	0.28	0.035	1.385	0.058	0.044	0.022	0.023	0.003	0.155	1.54	No	8— 400 2— 600	1— 10,000 1— 6,250 2— 1,500
138	20,000 See footnote[13]	50.6	89,089,000	23,000	67,007	14,027	10.8	4.52	1.51	21,200	0.328	0.039	0.044	0.412	0.032	0.121	0.079	0.0003	.....	0.232	0.644	Yes	4— 1,242 Adding 3, totaling 35,000 kw.	1— 20,000 1— 15,000
175	20,000	3.3	5,857,205	13,700	20,574	13,800	8.0	7.86	7.12	98,300	2.763	1.254	0.234	4.251	0.059	0.368	0.093	0.109	0.013	0.641	4.892	No	12— 650	2— 5,000** 1— 2,000 1— 7,500
163	19,350	39.4	66,884,900	16,900	172,129	11,500	12–15	3.65	5.14	59,100 See footnote[14]	0.938	0.169	0.136	1.243	0.006	0.099	0.029	0.003	0.005	0.142	1.385	Yes..	4— 800 12— 500	2— 1,000 1— 4,000†† 1— 3,350
50	18,000	33.5	53,059,470	15,000	90,940	10,000	22.0	2.36	3.43	34,300	0.405	0.163	0.048	0.616	0.006	0.091	0.001	0.027	0.002	0.128	0.744	.....	10— 500 1— 600 1— 509	2— 5,000 1— 10,000 1— 5,000 1— 3,000
208	18,000	23.8	37,575,960	9,600	61,073	12,522	16.4	6.16	3.25	40,700	1.090	0.120	0.016	1.226	0.009	0.057	0.032	0.005	.....	0.103	1.329	.....	7— 600 2— 520	1— 7,500†† 3— 500 2— 2,000
40	16,500	27.2	39,372,170	11,300	53,600	12,000	10.0	5.81	2.82	33,800	0.803	0.18	0.02	1.003	0.02	0.153	0.04	0.02	0.002	0.235	1.238	.....	6— 685 4— 306	1— 5,000 2— 6,000 1— 2,000 1— 2,500
23	16,250	25.2	35,979,455	88,000	49,532	11,500 to 12,500	16.5	3.58	2.75	33,000	0.559 See footnote[15]	0.128	0.036	0.723	0.008	0.079	0.030	0.008	0.006	0.131	0.854	No	7,600	1— 16,250
25	16,000	31.6	44,321,480	13,100	46,733	13,200	8.0	4.80	2.10	27,800	0.504	0.168	0.048	0.720	.....	.....	.....	.....	.....	0.055	0.775	.....	6— 846	1— 10,000
273	16,000	14.0	20,033,319	6,000	24,380	14,800 10,000 for coke breeze	6.0	7.77	2.44	36,100	0.946 See footnote[16]	0.311	0.098	1.355	0.048	0.055	0.107	0.042	0.019	0.270	1.625	Yes	2— 350 8— 400 1— 880	1— 6,000 2— 2,250* 1— 7,500 1— 4,000
27	15,200	15.1	20,130,130	5,600	41,104	11,000	14.0	4.32	4.08	45,000	0.885	0.187	0.022	1.093	.....	.....	.....	.....	.....	0.076	1.169	No	10 totaling 4,900	5 totaling 15,200
286	15,000	31.0	40,805,000	12,400	60,278	11,000	11.5	2.81	2.94	32,400	0.400	0.150	0.210	0.760	.....	.....	.....	.....	.....	0.180	0.940	.....	5,000	15,000
232	12,500	34.8	38,128,500	14,300	53,197	9,891	7.0	3.00	2.89	28,600	0.450	0.169	0.029	0.648	0.008	0.078	0.032	0.013	.....	0.131	0.779	No	5— 750	1— 12,500
214	11,500	27.9	28,163,600	7,500	32,488	14,400	5.8	7.69	2.30	33,150	0.925	0.190	0.095	1.210	0.010	0.089	0.074	0.015	.....	0.188	1.398	Yes	3— 520 6— 600 1— 400	1— 3,500 2— 2,500 1— 1,000 2— 1,000¶
288	11,000	33.9	32,728,000	9,000	45,365	14,000	12.0	2.99	2.78	38,900	0.410	0.090	0.090	0.590	.....	.....	.....	.....	.....	0.060	0.650	.....	3,700 hp. in 8 boilers	3 turbines, totaling 9,000
269	10,800	20.3	19,210,150 See footnote[17]	10,300	69,927	12,149	23.3	1.88	7.29	88,600	0.697	0.360	0.070	1.127	0.007	0.180	0.090	0.009	.....	0.286	1.413	No	2— 950 8— 250	1— 5,000 1— 3,000 1— 2,000 1— 500§§
283	10,200	32.1	28,760,070 See footnote[18]	6,800	41,150	13,900	7.9	4.57	2.86	39,800	0.654	0.405	0.016	1.075	0.011	0.015	0.041	0.004	.....	0.071	1.145	Yes	8 boilers	1— 300§§ 3 turbines 2 engines
11	10,200	58.7	52,519,034	11,500	83,123	.....	.....	2.00	3.16	.....	0.320	0.120	0.020	0.460	0.003	0.050	0.009	0.009	0.004	0.075	0.535	Yes	10— 320	2— 1,300‖‖ 1— 3,000 2— 1,000 1— 3,200
49	10,000	35.8	31,457,100	10,800	42,195	13,500	11.0	6.16	2.68	36,200	0.823	0.207	0.016	1.046	0.006	0.146	0.028	0.002	0.0007	0.183	1.229	.....	3— 713 1— 732 2— 981	2— 5,000
48	10,000	19.9	17,463,570	6,000	22,975	11,000	12.0	5.53	2.63	29,000	0.727	0.208	0.011	0.946	0.001	0.035	0.008	0.004	0.003	0.051	0.997	.....	5— 600	2— 5,000

[1] Burns natural gas and coal; coal given is equivalent coal; actual coal burned is 78,586 tons.
[2] Auxiliary to hydro power.
[3] Burns coal and oil.
[4] Boiler plant equivalent to 36,000 kw.
[5] Turbine rated at 20,000 kw. added 11/17/21; 6 boilers 5/27/21.
[6] Energy purchased, 9,297,600 kw.-hr. not included.
[7] Burns powdered fuel.
[8] Burns natural gas and coal.
[9] Five months' operation; first turbine and two boilers started 10/16/21; second turbine and two boilers put in service 10/18/22.
[10] Burn coal and oil.
[11] Only 19,250 kw. in use.
[12] Coal price delivered in bunkers.
[13] Installed generator rating is 35,000 kw., but boiler capacity is limited to 20,000 kw.
[14] Include cost of steam to large heating load.
[15] Fuel expense includes ash handling.
[16] Burn coke breeze.
[17] 50 per cent of consumption in district served supplied by water power requiring 100 per cent steam reserve in readiness all the time; burns low-grade, high-ash, small-size anthracite.
[18] Energy consumed for excitation not included.
* Kva. † Engine-driven direct-current generator. ‡ Compound Corliss. ‖ Mixed-pressure turbine. § Hp. ¶ Reciprocating engine. ** Standby plant. †† One 1,000-kva. unit being removed and one 5,000-kva. unit installed. ‡‡ Installed 11/15/21. ‖ ‖ Corliss engines. §§ Engine driven sets.

its output larger, and to the further fact that the fuel expense is low owing to the proximity of the plant to a mine. Furthermore, the maintenance expense is minimized by operating the plant below rating.

If the fixed charges on some of these plants could be uniformly and accurately ascertained, the unit overall costs might rank in a totally different order. It remains for some one to study the combined fixed and operating costs to ascertain how much money a company can afford to spend for refinements in equipment. Here again, however, it is necessary to determine whether an increase in operating expense is not justified by the greater reliability of service which may be assured.

Aside from plant No. 57, the station operating at the lowest unit cost (exclusive of fixed charges) is No. 53. This plant is producing a kilowatt-hour at 0.470 cent, but it has a 60,000-kw. unit and is operating at 58.2 per cent plant factor. As may be seen, its maintenance expense during the period covered had not yet reached large proportions.

Among the larger stations, No. 64 has the highest production expense—namely 0.894 cent per kilowatt-hour —because of the combination of low plant factor, high coal charge, high wages and high boiler-plant maintenance. Similar conditions obtain for station No. 12, and more particularly for No. 175. The expenses of the latter indicate what must be paid for standby service.

Of particular concern to companies interested in burning powdered coal are the operating economy and production expenses of station No. 184, which is rated at 40,000 kw. With coal containing 11,961 B.t.u. per pound and costing $4.94 per short ton, this station is producing a kilowatt-hour on 19,200 B.t.u. The operating expense is only 0.469 cent per kilowatt-hour, and the total production expense is 0.510 cent per kilowatt-hour. Although these figures answer some of the principal questions which have been raised in engineers' minds, it would be interesting to know what the fixed charges on stations of this character are.

To enable readers to interpret the figures, the accompanying table was sent to each company submitting data with the request that explanations be given for results where they differ very much from the average for the group. Some of the comments are incorporated in the table as footnotes. Others, arranged in the same order as that in which the companies are listed (i.e., according to rating), are digested below:

No. 115.—From Sept. 1, 1922, to April 1, 1923, the production expenses considerably improved. They are:

	Cents per Kw.-Hr.
Average fuel cost	0.460
Average labor cost	0.127
Average water, lubrication and supplies cost	0.014
Total operating expense	0.601
Total maintenance expense	0.095
Grand total	0.697
Average pounds of fuel per kw.-hr.	1.932

During this period (on Aug. 16, 1922) a 20,000-kw. turbine was put in operation. The labor expense is above the average, largely owing to the fact that the plant is rambling; i.e., it covers considerable territory and has several floor levels. In order to safeguard against failure of one of the large machines it is necessary to have enough help to put one of the smaller units in service in an emergency.

No. 84.—"In comparing our station with others covered by this report, one point comes to my attention which I think would be well to incorporate in your form, that is, the number of B.t.u. for 1 cent. With the above figure it would be very easy to compare the relative operating conditions of the different plants and would permit a much more rapid comparison of the production costs of the various stations, instead of trying to compare the cost of coal and B.t.u. per pound."

No. 12.—Coal price is higher than others of group and plant factor is lower.

No. 186.—"Since putting two new 1,500-hp. boilers in service, our B.t.u. per kilowatt-hour for the past three months has averaged 19,723."

No. 184.—The third unit of this plant was placed in service in October, 1922. Since July 1, 1922, the fuel economy has improved somewhat, although the plant factor is slightly less. Figures follow:

Installed generator rating of station, kw.	70,000
Station output in kw.-hr. for year ended Dec. 31, 1922	253,046,466
Peak load for same period	58,000
Annual plant factor (net output in kw.-hr. divided by 8,760 times installed kw.), per cent	41.27
Fuel (coal or oil) consumption for same period, lb.	391,953,556
Average B.t.u. per lb.	12,056
Coal, lb. per switchboard kw.-hr.	1.55
B.t.u. per switchboard kw.-hr.	18,674
Average price of fuel delivered per short ton	$5.47
Operating expenses, cents per kw.-hr. delivered from switchboard:	
(a) Fuel	0.4234
(b) Wages and superintendence	0.0594
(c) Water, lubricants, supplies, etc.	0.0058
Maintenance expense, cents per kw.-hr. delivered from switchboard:	
(a) Station buildings and structures	0.0015
(b) Boiler plant	0.0199
(c) Prime movers and auxiliaries	0.0036
(d) Generators and other electrical equipment	0.0024
(e) Miscellaneous equipment	0.0121
Number, type and rating of boilers	Eight 1,306-hp. Edge Moor
Number, type and rating of prime movers (turbines)	Two 20,000-kw. G. E. horizontal One 30,000-kw. G. E. horizontal

No. 57.—"The pounds of coal per kilowatt-hour for our plant is probably below the average. This is due mostly to the fact that the equipment was run during this period at its most economical loading. The grand total cost is also possibly below the average, due to the fact that the mine from which the power-plant coal is obtained is immediately adjacent to the plant. Consequently we have no freight to pay on coal."

No. 234.—"Our maintenance expenses are only divided between boiler department and generating department. These divisions are as follows:

	Cents per Kw.-Hr.
Total generator-room maintenance	$0.0466
Total boiler-room maintenance	0.0384
Total	$0.08508

"This gives a total operation and maintenance expense of 0.92308 cent per kilowatt-hour."

No. 85.—"Since July 1, 1922, we have made a great many changes in this plant, which was in very poor condition in the year 1921, and have raised its economy very materially. The coal rate has been reduced from 2.30 lb. per kilowatt-hour to 1.77 lb., reducing the B.t.u. from 33,350 to 25,665 per kilowatt-hour. Figures for the first three months in 1923 follow:

Installed generator rating, kw.	33,000
Annual plant factor, per cent	37.7
Annual output, kw.-hr.	26,925,400
Peak load, kw.	23,500
Fuel consumption, short tons	23,919
Average B.t.u. per lb.	14,500
Average ash, per cent	6.8
Price of fuel delivered	$6.80
Lb. fuel per kw-.hr.	1.77
B.t.u. per kw.-hr.	25,665
Operating expenses (cents per kw.-hr. delivered):	
Fuel	$0.612
Wages and superintendence	0.093
Water, lubrication and supplies	0.008
Total	0.714
Maintenance:	
Building and structures	0.003
Boiler plant	0.022
Prime movers and auxiliaries	0.007
Generator and electrical equipment	0.025
Miscellaneous	0.00003
Total	0.058
Grand total	0.773
Rating of boilers (sixteen), each, hp	512
Rating of generators:	
Three, each, kw.	10,000
One, kw.	3,000

No. 208.—"The large coal consumption per kilowatt-hour for the period covered by this questionnaire was due to the fact that on account of an accident to our 5,000-kw. unit we were forced to operate the older equipment for several months. At present our coal consumption is about 2.5 lb. per net kilowatt-hour, using coal with a heating value of approximately 12,250 B.t.u. per pound."

No. 11.—Low cost of coal is due to station being contiguous to mines.

No. 49.—Since July 1, 1922, the following results have been obtained:

Annual plant factor, per cent	41.0
Average ash, per cent	9.07
Lb. fuel per kw.-hr.	2.57
B.t.u. per kw.-hr.	34,695

Straight Lines as Rate Curves

A New Method for Making Rate Studies by Using Graphical Charts—Hyperbolic Curves Reduced to Straight Lines Without Making Calculations—Greater Accuracy and Convenience Secured

By H. E. EISENMENGER
New York Edison Company

IF RATE schedules are to be graphically expressed by curves, the almost universally chosen method is to plot the cents per kilowatt-hour on a vertical scale over the kilowatt-hours consumed. This results in curved lines. Just as some other curves can be turned into straight lines by using a logarithmic scale so these curves can be straightened if the kilowatt-hours are plotted on a "reciprocal" or "hyperbolic" scale. The design of this kind of scale, which is a very simple matter, is explained in the article. A scale of this kind, once constructed, can be reproduced by blueprinting, photostating, etc., and used for all subsequent work with rate curves just as the ready-made logarithmic scales are used for other investigations.

The use of the hyperbolic scale not only results in a great simplification, with a consequent saving of time and work, but it has also several other advantages which are fully explained in the article. Its principal application is in the study of rates and in the design of new rates.

In the latter part of the article other methods of rate representation and of rate comparison are discussed which make use of straight lines only.

GRAPHICAL representation of central - station rates for the purpose of comparing different rates, for designing new rates, etc., is, as a rule, carried out by plotting the average charge in cents per kilowatt-hour against the number of kilowatt-hours. This will generally not result in straight lines, except in case of the first block of a block rate or in case of a step rate. In practically all other cases curved lines result, notably for the various kinds of block rates. Even in case of step rates, curved lines join the straight lines to one another where the stipulation is made that the application of the lower step shall not make the bill for a larger consumer less than for a smaller consumer or *vice versa*. In other words, where there is an unchanged bill over a certain range of kilowatt-hours, also where the cents per kilowatt-hour are plotted as a function of the load factor, curved lines as a rule result.

The construction of these curved lines is a tedious work and must be preceded by the calculation of a table giving the values for a sufficient number of points of the curve. Even with the use of a calculating machine or where a slide rule is accurate enough, this work takes up much time. The accuracy of the curve is rather limited because a curved line can be made to follow points which are slightly wrong and does not show the consequent distortion from its true shape as readily as a straight line will.

For these and other reasons it is desirable to replace these curves by straight lines through the use of an appropriate scale. Double logarithmic scales will accomplish this, but they require a shifting of the scale for every block, which makes them worthless for this particular purpose.

I have shown in my book on "Central Station Rates"* (pages 360-365) that the curves in question are equilateral hyperbolas, the vertical asymptotes of which are identical with the axis of ordinates—that is, with the axis of cents per kilowatt-hour—whereas the horizontal asymptote is raised over the horizontal axis, or axis of kilowatt-hours, by an amount which is equal to the cents per kilowatt-hour charged in the respective block for the incremental kilowatt-hour. In case of constant bills (intermediate stages in step rates, also minimum bills) the horizontal asymptote is identical with the horizontal axis.

These fundamental facts bring the thought near that it must be possible to stretch these curves into straight lines if we step off the horizontal distances (kilowatt - hours) on a hyperbolical scale, so that the change of the horizontal distances which corresponds to a constant vertical distance in the original curve is offset by an equal but opposite change of the length of the unit on the horizontal scale. The exact proof that the curves must actually become straight lines is easy with the material on hand in the theoretical part of the book mentioned above, but no space shall be taken up with this point in the present article, which is concerned with the practical side of the question only.

How to Construct the Scale

The scale is constructed in the following manner: Take a convenient horizontal length *MN* (bottom of Fig. 1) as unit; for instance, 100 divisions of a cross-section paper. Step off from the right-hand side *N* toward the left one-tenth of this length and call the point thus received 10. Then step off from *N* to the left a length equal to one-ninth and call the point 9; the point at a distance of one-eighth to the left of *N* will be called 8, and so on until the point 1 is reached, which is at *M*. Fractional values are determined in the same way; for example, the point at the distance 1/1.5 to the left of *N* is called 1.5, etc. In this manner as many points of the scale as seems desirable are determined. On account of the small size of the illustrations fewer of these points are shown in Fig. 1 than will be used for purposes of practice. One could, of course, also continue to the left of the point *M* and enter the points 0.9, 0.8, etc., but this will seldom result in any advantage. The range from 0.5 to 1 in this manner would take up more space than the entire range from 1 to 10. The point *N* represents infinity and the vertical line drawn through this point (dash-and-dot line) will be called the "infinity line." The vertical scale is an ordinary arithmetical cents-per-kilowatt-hour scale.

The use of the sheets ruled in the manner just

*"Central Station Rates in Theory and Practice," by H. E. Eisenmenger, Fred J. Drake & Company, Chicago, 1921.

described is best explained by an example. Suppose we have a block rate of 10 cents per kilowatt-hour for the first 10 kw.-hr. and 5 cents per kilowatt-hour for each kilowatt-hour after the first ten.

Each unit of the horizontal scale is assumed to represent 10 kw.-hr., so that the figures at the bottom of the sheet are to be multiplied by ten in order to give the number of kilowatt-hours and the point M denotes 10 kw.-hr. There is now one point of the curve obviously at the height 10 cents per kilowatt-hour above M; this gives the point A_1 in Fig. 1. All there is to do now to draw the curve is to step off 5 cents per kilowatt-hour (that is, the charge in the second block) on the infinity line upward from N, which gives the point B_1, and then to join A_1 and B_1. (For ∞ kw.-hr. the average charge per kilowatt-hour is 5 cents). This

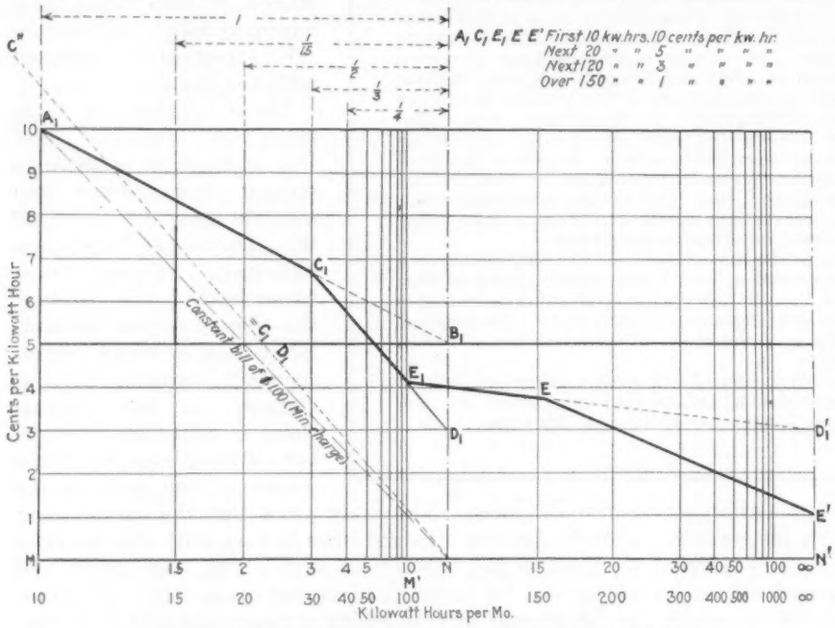

A, C, E, E' First 10 kw.hrs. 10 cents per kw. hr.
Next 20 " " 5 " " " "
Next 120 " " 3 " " " "
Over 150 " " 1 " " " "
Cents per Kilowatt Hour
Kilowatt Hours per Mo.
Constant bill of $1.00 (Min. charge)

FIG. 1—CONVERTING BLOCK RATES TO STRAIGHT LINES

will immediately give the desired curve without any figuring.

Suppose now there is a third block commencing at 30 kw.-hr. and that all kilowatt-hours in this block are charged at 3 cents per kilowatt-hour; then one takes the intersection point C_1 of the rate curve A_1B_1 with the vertical which is laid through the point 3 (30 kw.-hr.) and joins it to the point D_1, which is found at the height 3 cents per kilowatt-hour on the infinity line.

Now, it will be observed that in the higher ranges of kilowatt-hours—say, above 100 kw.-hr.—the horizontal scale becomes very much compressed. If desired, this portion of the horizontal scale can easily be expanded in the following manner:

Draw a scale $M'N'$, which is identical with MN, but use figures ten times as large, placing M' on the point 10 of the original horizontal scale. In this way another infinity line is obtained starting upward from the point N'. The old infinity line is then, as can be easily seen, located at the point $1/0.9 = 1.111$ of the new scale. Take now the intersection E_1 of the rate line with the vertical line drawn through the point 10 and connect it to the point D_1, which is situated at the distance 3 cents per kilowatt-hour above N' on the second infinity line. This gives the equivalent of the portion E_1D_1 of the rate line over the expanded scale $M'N'$. The original and the added portion of the diagram shall be called "sections."

Just to carry the example further, assume now a fourth block beginning at 150 kw.-hr., all kilowatt-hours in this block to be charged at 1 cent. EE' gives then the rate curve in this block.

One is, of course, not restricted to making the change of the scale at the point 10. It may be made at any other point that seems desirable, but as a rule this will be the most convenient point in practice. One can also, of course, add a third section to the right of N representing 100-1,000 units; that is, in the case under consideration, 1,000-10,000 kw.-hr.

It is possible also (according to a suggestion by William B. Jackson) to run each section to the infinity line and start the next section a short distance, say one-half inch, to the right of the infinity line, so that each section is entirely separated from the other and no overlapping of scales occurs. With the former method the space between 10 and N has two scales because the point N represents infinity on the first section and 11.111 on the second. The gap between the line representing 10 in the first section and the line representing 10 in the second section must then be bridged by horizontal lines; in other words, the points on the line representing 10 on the section to the left must be projected horizontally to the beginning of the new section.

The line representing a minimum charge is constructed in an equally simple way with the use of a hyperbolic scale. For example, if there is a minimum charge of $1, the curve representing this charge is found in the following way: One dollar means at a consumption of, say, 10 kw.-hr., an average charge of 10 cents per kilowatt-hour, and point A_1 is therefore one point of the line. The bottom point of the infinity line N must be of necessity another point of that line, because at infinity kilowatt-hours and a constant bill of $1 the average charge is zero. A_1N is therefore the line representing a minimum charge $1.

The same applies for every constant charge such as are frequently found between the steps of step rates. Take, for example, a step rate as follows: If the consumption is 150 kw.-hr. or less, 8 cents is charged for every kilowatt-hour; if the consumption is more than 150 kw.-hr., 6 cents is charged for every kilowatt-hour. No bill for a larger consumption is, however, to be smaller than that for a smaller consumption. There results then (Fig. 2) a straight horizontal line at the height of 8 cents per kilowatt-hour until it hits the 150-kw.-hr. line. From there the straight line drops toward the point N until it reaches the 6-cents-per-kilowatt-hour line (which, as the figure shows directly and without any computation whatsoever, takes place at 200 kw.-hr.), and from there on the rate curve proceeds as a straight horizontal line. The inclined straight-rate line also indicates, without figuring, how large that constant bill is. The line, produced, intersects the 1,000-kw.-hr. line at 1.2 cents per kilowatt-hour (or the 100-kw.-hr. line at 12 cents per kilowatt-hour), and therefore the bill is 1,200 cents or $12.

It will be noted that in each case the entire rate curve has been drawn without a single calculation, which compares favorably with the long tables that have to be tediously figured out to obtain a curve of similar accuracy under the old system with an arithmetical horizontal scale. The plotting of a large number of points from the table becomes also unnecessary with the new system.

A third advantage is that the loss of time connected with the tracing of curved lines is avoided.

If, therefore, the scale is once laid out, a very considerable saving of work and time is effected for all future rate curves. Printed sheets with rulings after a hyperbolic scale comparable to the well-known log or double-log sheets are not yet on the market as far as the author is aware. But an ordinary cross-section sheet of generous dimensions about 20 in. high and 10 in. wide for each section (to insure accuracy) can be easily ruled with a hyperbolic scale by any good draftsman in a short time and can then be cheaply and quickly reproduced in any quantity and any size by photographic methods as a photostat, blueprint or Van Dyke print. The method of reproduction preferred by the author is a Van Dyke negative direct-printed copy, from which positive contact prints are taken which may be blueprints or black or brown prints. The latter are preferable if it is intended to photostat the sheet after the rate curves have been entered, because blue lines will photostat poorly. It is advisable to rule three sections on this master sheet, every point of each section representing ten times as many kilowatt-hours as the corresponding point on the neighboring section to the left.

The advantages of saving time and work are not the only ones of this straight-line method.

Where two or more rates are compared by means of the curved-line method, the curvature distorts the impression to be conveyed by the curve. Supposing, for instance, as a simple case, that there are two rate curves, one running above the other at a constant vertical distance of 0.1 cent per kilowatt-hour, both curves will come very closely together in the range of the low kilowatt-hours where the curves are very steep, and this may go so far that the two curves finally even run together and cannot be distinguished from one another because their mutual distance is smaller than the thickness of the lines (Fig. 3). On the right-hand end of the curves, where the energy consumptions are high and the curves almost horizontal, the distance between the two curves is practically 0.1 cent per kilowatt-hour. The curves will therefore give the impression of converging toward the left, or even of crossing at some point near their left end, although their vertical distance from one another is constant and equal to 0.1 cent per kilowatt-hour. An experienced person may discount this apparent convergence, but where the vertical distance is only approximately constant he will not be able to tell without measurements where the curved lines are converging to the left and where they are converging to the right, or whether they are parallel. Measurements are uncertain in the steep parts of the curves. Straight lines have an unchanged slope, and it is seen at a glance with a great degree of accuracy whether the lines are converging to the right or to the left, or whether they are parallel. Similar considerations apply, for instance, where one curve is by a constant percentage (discount) higher or lower than the other.

At the end of each block the rate curve, whether under the old or the new system of representation, must show a characteristic break, a sudden change downward of its slope. If the change in the kilowatt-hour charge at the end of a certain block is not great, the angle caused thereby in the curved line may be so small that it is overlooked when tracing the curve, and the curve is thus wrongly smoothed out. This introduces a further element of uncertainty and inaccuracy into the curve and obliterates the expression of the law of the curve, as becomes particularly evident where there are two or more rate curves which run very close to each other. They may then, although plotted with great care, alternately converge and diverge in an apparently unjustified and confusing way, without pronounced breaks, which gives them an erratic, slovenly appearance and gives rise in the spectator to suspicions as to their accuracy. With a straight-line system the changes of slope at the end of each block are not only clear-cut and more pronounced, but they cannot possibly be overlooked when constructing the curve. This makes it much more easy for the eye to grasp the law which the various rates curves follow, even though the changes in slope be small and the curves close together.

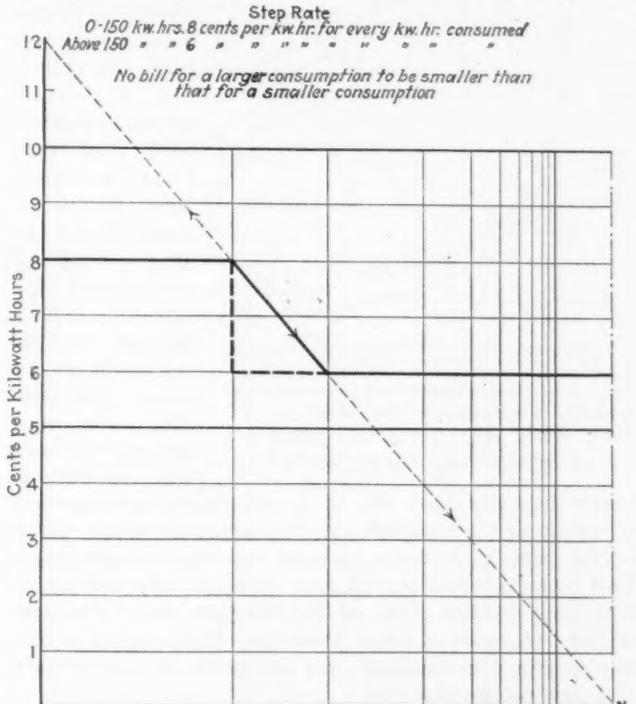


FIG. 2—CONVERTING STEP RATES TO STRAIGHT LINES

Another advantage is that the straight-rate lines are self-descriptive. By looking at a rate line of this kind one can read off the rate in words as easily as if it were printed, and even more readily. The breaks in the slopes indicate the ends of the blocks and the intersection of each straight line (or of its production respectively to the right) with the infinity line gives the cents per kilowatt-hour charged within the respective block. A rate curve under the old system has nothing to show to the eye what the charges are, and if the description of the sheet has been omitted or is not at hand, it is not possible to find what the rate is, except by solving equations with two unknown quantities.

This system of straight-line representation of rates is especially useful in designing new rates to take the

place of existing ones. In this case one wants to know what the resulting changes are in the cent-per-kilowatt-hour charges if certain features of the rates are changed—for instance, the length of a block or the charge per increment kilowatt-hour in that block, or both. The effect of these changes in one or more blocks can be demonstrated by simply tracing a straight line. The connection between the original rate and the tentative new rate is much clearer than under the old system with its elaborate calculations and curve tracings.

It is known, for example, that the rate line in every block of any block rate, no matter what the upper and lower limit of that block or how high the rate is for a certain energy consumption, converges to the same point of the infinity line as long as the increment kilowatt-hour charges within the block are the same. Two parallel rate lines indicate always that one rate is lower than the other one by a certain constant number of cents per kilowatt-hour, this number being given by the vertical distance between the two straight lines. Two lines intersecting at any point on the horizontal zero line (bottom line) of the diagram mean that one of the two rates is lower than the other one by a certain constant percentage—for instance, in consequence of a percentage discount.

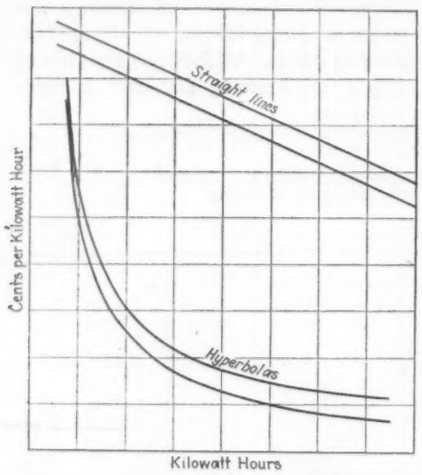


FIG. 3 — COMPARISON OF HYPERBOLAS HAVING A CONSTANT VERTICAL SEPARATION WITH STRAIGHT LINES HAVING A CONSTANT VERTICAL SEPARATION

As shown in the theoretical part of the book on rates quoted above, the total amount in dollars and cents charged under any block rate can be resolved into a constant amount plus another amount which is proportional to the total number of kilowatt-hours consumed. These two component parts of the charge are also easily evident from the straight-line representation. A parallel to the rate line is traced through the bottom of the infinity line. This parallel intersects the 10-kw.-hr. or the 100-kw.-hr. or the 1,000-kw.-hr. line, etc., respectively, at a height above the zero line which is one-tenth, one-hundredth, one-thousandth, etc., of the above-named constant component of the charges. The amount proportional to the total number of kilowatt-hours is, of course, equal to the kilowatt-hour charge per increment kilowatt-hour in the respective block and is given, as stated above, by the intersection of the rate line with the nearest infinity line to the right. Thus the equivalent two charges in the third block (3 cents per kilowatt-hour for every kilowatt-hour between 30 and 150) of the 10/5/3/1-cent rate dealt with in Fig. 1 will be found as 1.1 × 100 + 3 cents per kilowatt-hours, or \$1.10 + 3 cents per kilowatt-hour. This can be seen, on the one hand, from the intersection point of the parallel $C''N$, for instance, with the 10-kw.-hr. line, which takes place at 11 cents per kilowatt-hour, and, on the other hand, from the intersection of C_1D_1 with the infinity line at 3 cents per kilowatt-hour.

From this is seen the following general law: The slope of the line determines the additive constant (equivalent customer charge) of the respective block, and the intersection of the line with the infinity line determines the cents-per-kilowatt-hour charge for the increment kilowatt-hour in the respective block.

The hyperbolic scale offers the same advantages where the cents per kilowatt-hour are to be plotted against the load factor. This is often done to advantage where a certain charge is made per kilowatt with or without the addition of a separate kilowatt-hour charge. Here an even greater simplification is noticeable through the use of the hyperbolic scale.

Take, for example, as a simple case, the following Hopkinson rate: \$3 per kilowatt per month and 5 cents per kilowatt-hour. The average charge per kilowatt-hour varies not only with the energy consumption but also with the demand. With the energy consumption as abscissas, there would have to be separate curves for several representative demands; for instance, for 50, 100, 200 kw., etc. If, however, the cents per kilowatt-hour are plotted as a function of the load factor, a single curve will suffice which applies to every kilowatt demand.

To construct this curve choose one section of the scale for the range from 10 per cent to 100 per cent load factor (Fig. 4). If it is desired to take load factors of less than 10 per cent into the scope of the investigation, the preceding section might be used also or the scale extended back to 9 per cent, 8 per cent, etc., as desired. Choose, for example, a demand of 50 kw. (the demand cancels out later) at 10 per cent load factor. This means that the energy consumption is 0.10 × 50 kw. × 730 hours = 3,650 kw.-hr. The total bill is then (in cents) 50 kw. × 300 cents per kilowatt-hour + 3,650 kw.-hr. × 5 cents per kilowatt-hour, and the average charge in cents per kilowatt-hour is [(50 × 300) ÷ (0.10 × 50 × 730)] + 5 = 9.11 cents per kilowatt-hour. At infinity load factor the demand portion would be zero,

RATE SYSTEMS AND GRAPHICAL POSSIBILITIES

Method	2 Step off on the two axes the following values: One Axis	3 Step off on the two axes the following values: Other Axis	4 Assume at a constant value, one for each curve of the family	5 Rate line with ordinary arithmetic scale	6 Rate curve straightened if hyperbolic scale is used on the axis referred to in Column 2 or 3
1	Average charge in cents per kilowatt-hour	Demand	Energy consumption	Straight	.....
2	Average charge in cents per kilowatt-hour	Demand	Load factor	Curved	Column 3 (demand)
3	Average charge in cents per kilowatt-hour	Energy consumption	Demand	Curved	Column 3 (energy)
4	Average charge in cents per kilowatt-hour	Energy consumption	Load factor	Curved	Column 3 (energy)
5	Average charge in cents per kilowatt-hour	Load factor	Demand*	Curved*	Column 3* (load factor)
6	Average charge in cents per kilowatt-hour	Load factor	Energy consumption*	Curved*	Column 3* (load factor)
7	Demand	Energy consumption	Average charge in cents per kilowatt-hour	Straight	.....
8	Demand	Load factor	Average charge in cents per kilowatt-hour	Curved	Column 2 (demand)
9	Energy consumption	Load factor	Average charge in cents per kilowatt-hour	Curved	Cannot be straightened in general

* In case of a Hopkinson or Wright rate without blocks, the same rate line applies to all demands with method 5 and to all energy consumptions with method 6.

and at the infinity line (which now represents "infinity load factor") the average charge per kilowatt-hour will be equal to the energy charge of 5 cents per kilowatt-hour. Connection is made on the chart by a straight line between the point 9.11 at 10 per cent load factor with the point 5 cents per kilowatt-hour on the infinity line, and the desired rate curve appears as *AB* (Fig. 4).

If there are blocks in the Hopkinson rate, even this load-factor rate curve will in general vary with the demand, and it will be necessary to draw separate rate curves for a number of representative demands.

Take, for example, the Hopkinson rate just quoted but modified by the addition of blocks for the higher kilowatts and kilowatt-hours, as follows:

> $3 per kilowatt per month for the first 100 kw.
> $2 per kilowatt per month for all kilowatts in excess of 100 kw.
> 5 cents for the first 5,000 kw.-hr.
> 3 cents for the next 5,000 kw.-hr.
> 1 cent for all kilowatt-hours in excess of 10,000.

The curve for 50-kw. demand will remain unchanged from the above until it reaches the load factor at which the first block of 5,000 kw.-hr. is filled, that is at 5,000 kw. ÷ (50 kw. × 730 hours) = 13.70 per cent* (point *C*, Fig. 4). From there on it is necessary to draw a straight line *CD* to the point of 3 cents on the infinity line. This straight line is the rate line until the second block of 5,000 kw.-hr. is filled, which takes place at 2 × 13.70 per cent = 27.40 per cent. Connecting the point *E* at 27.4 per cent of the last-named rate line with the point *F* at 1 cent per kilowatt-hour on the infinity line furnishes the rest of the rate curve up to the 100 per cent point. In like simple manner the rate curves for 100 kw. and 200 kw. are constructed. They are also entered in Fig. 4.

This example furnishes an instance of the general type of rate, inasmuch as the kilowatt charge and the kilowatt-hour charge decrease with increasing demand or energy consumption respectively. The average charge in cents per kilowatt-hour depends then on both the demand and the energy consumption in such a way that one can no longer use a single curve with the load factors on the base line, as was possible with the elementary Hopkinson rate (*AB*, Fig. 4). In this case nine different methods can be used for the representation of the rate on paper, as explained in the following. Only one of these nine methods has been applied in the example above.

General Type of Rate

The monthly or annual charge made under any electric rate is practically always a function of not more than three variables, viz., the energy consumption, the demand, and the time at which the energy has been consumed. The latter element cannot be taken care of in the graphical representation otherwise than by tracing different curves for the different times at which the energy is being consumed or, in other words, at which the demand occurs. It can therefore be disregarded for the present purposes.

Instead of either one of the variables, demand and energy consumption, the load factor can be substituted as variable and the general problem thus becomes: What is the average charge per kilowatt-hour for any possible combination of values of the following sets of variables: (1) Demand and energy consumption, (2) demand and load factor, (3) energy consumption and load factor?

This means that there are the following combinations of variables: (A) Average charge, demand and energy consumption; (B) average charge, demand and load factor; (C) average charge, energy consumption and load factor.

Given any two variables in any of the three last-named combinations, it is requisite to show graphically what the third one is. This cannot be done by curves in a plane otherwise than by assuming one of the three variables at a number of representative constant values and drawing a separate curve between the two other variables for every one of these representatives values.

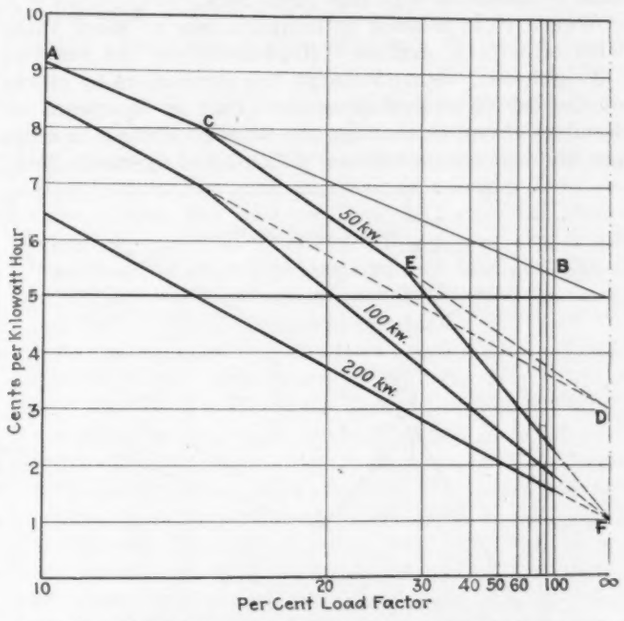


FIG. 4—HYPERBOLIC SCALES APPLIED TO RATES PLOTTED TO LOAD FACTOR

Thus under (A) one might draw a number of curves showing the average charge with varying energy consumption if the demand is 50 kw., another curve for a demand of 100 kw., another for 200 kw., etc. Or one may draw another family of curves showing the average charge (cents per kilowatt-hour) with varying demand, one curve for a given energy consumption of, let us say, 500 kw.-hr., another for 1,000 kw.-hr., a third one possibly for 1,500 kw.-hr., etc. Or it might be shown by a curve between demand and energy consumption how the energy consumption varies with the demand if the average charge per kilowatt-hour is, for instance, 6 cents, by another curve the variation is shown for a constant value of 5½ cents, then for 5 cents, 4½ cents, etc., as far as the circumstances make advisable.

Likewise three different types of curves are arrived at for combination (B) and three for combination (C) —altogether nine different possibilities for the representation of the rate on a plane. Seven of these result in rate curves which are hyperbolas if straight arithmetical scales are used vertically and horizontally; therefore they will turn to straight lines if the horizontal (or vertical) scale is a hyperbolic one as described above. The remaining two possibilities result in straight lines if straight arithmetical scales are used, and the use of a hyperbolic scale would therefore complicate matters in these two cases. The table

*On a regular hyperbolic sheet for practical use sufficient subdivisions will be entered to allow the point 13.7 per cent to be found with practical accuracy. If such is not the case, it is easy to find on the slide rule the distance of this point from the 100 per cent point of the scale, as 1/1.37 = 73.0 per cent of the distance between the 100 per cent and 10 per cent points of the scale.

enumerates the nine possibilities, and in addition it shows which of these result in straight lines on ordinary arithmetical scales and which require the use of the hyperbolic scale to straighten them.

The proof for the statements of the last two columns in this table follows naturally from the material provided in the present author's serial "Some Geometrical Aspects of the Three-Charge Rate System,"† especially with reference to its Figs. 7 and 8a to 8m, but no space shall be taken up with this proof here.

Where it is desired to compare two or more rates with either an explicit (Hopkinson) or an implied (Wright, etc.) demand charge, the comparison by means of families of curves described so far—that is, by means of families of curves showing the average charges in cents per kilowatt-hour—becomes difficult and unsatisfactory.

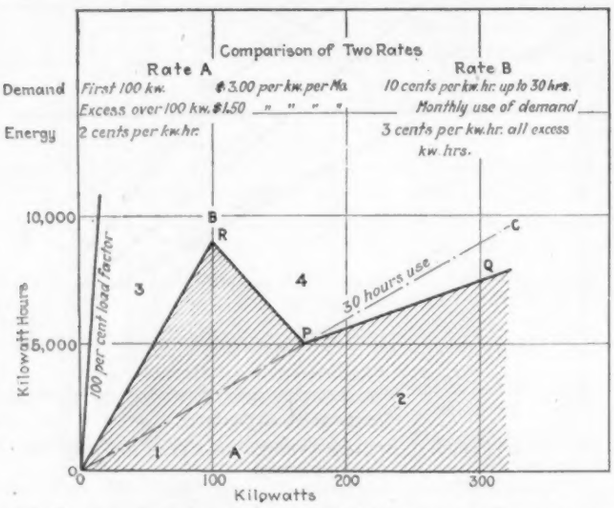


FIG. 5—ALL CUSTOMERS REPRESENTED BY POINTS IN THE SHADED AREA PAY MORE UNDER RATE A; THOSE IN THE NON-SHADED AREA PAY MORE UNDER RATE B

The following straight-line method is preferable. Lay out a system of co-ordinates with the kilowatts demand as abscissas (horizontal) and the kilowatt-hours consumption as ordinates (vertical) (Fig. 5). The points with equal load factors are then located on straight lines radiating from the origin 0. As far as the charges are concerned, every customer is characterized by a certain definite combination of demand and energy consumption; that means, he is characterized by a certain point in the system of co-ordinates just described. For the points on certain portions of the area of this system, rate A will be higher than rate B, and for the others the reverse will take place. One has now only to determine these portions of the area, and it can be seen at a glance for which customers rate A is higher and for which rate B. These areas are determined by straight lines whenever two three-charge rate systems are to be compared,‡ taking the term "three-charge system" in its widest meaning—that is, including those special cases where one or two of the three charges are zero. It will then be hard to find a rate system which does not come under the heading of "three-charge rate system."

A simple example shall illustrate this method. Let one of the two rates be a Hopkinson rate with the demand charge of $3 per kilowatt per month up to a demand of 100 kw., this charge to be reduced to $1.50 for every kilowatt above the first 100 kw. The energy charge is 2 cents per kilowatt-hour. The other rate, B, is a Wright demand rate as follows: 10 cents per kilowatt-hour for the first 30 hours' monthly use of the demand and 3 cents for every kilowatt-hour above that load factor.

Under rate A the average charge per kilowatt-hour follows a different law for the demand above 100 kw. from that for the kilowatts below 100. The line showing where rate A and rate B make the same charges may therefore be expected to have a break at the 100-kw. line *AB* in Fig. 5. Likewise the Wright demand rate B changes along the 30-hour monthly use *OC*. Thus there result four ranges (I, II, III and IV in Fig. 5), defined by the dash-and-dot lines *AB* and *OC*.

Calling d the demand of a customer in kilowatts and e his energy consumption in kilowatt-hours, then the total charges per month a_A under rate A in cents per month will be $a_A = 300d + 2e$ as long as $d < 100$ kw.; that is, in ranges I and III (Fig. 5).

Where $d > 100$ kw. there results:

$a_A = 300$ cents per kilowatt $\times$ 100 kw. + 150 cents per kilowatt $(d - 100$ kw.$) + 2e$

$= 15{,}000 + 150d + 2e$ ranges II and IV

Likewise we get for rate B:

$a_B = 10e$ ranges I and II

$a_B = 10 \times 30d + (e - 30d) \times 3 = 210d + 3e$ ranges III and IV

The locus of all combinations of demand and energy for which rate A charges the same as rate B is a straight line within each range. For all customers whose characteristic points are above this line rate A will be lower and vice versa. If it is desired to construct this straight line—for example, in Range IV—the amount a_A, which applies in this range, is set equal to a_B, also applying in this range, and there results:

$$15{,}000 + 150d + 2e = 210d + 3e,$$

$$15{,}000 = 60d + e,$$

which is the equation of a straight line.

To determine this line determine two of its points—for instance, the point on the line *OC* and the point on the line *AB*. In the former case e will be $= 30d$, which changes the above equation to $15{,}000 = 90d$, from which $d = 166\frac{2}{3}$ kw.; consequently $e = 30d = 5{,}000$ kw.-hr. This gives point *P* in Fig. 5. The point on line *AB* is found by letting $d = 100$ in the equation of the straight line. This results in $e = 15{,}000 - 6{,}000 = 9{,}000$ kw.-hr. (point *R*). One thus gets the straight line *PR*, and repeated application of the same principle results in the construction of the broken straight line *ORPQ*. All customers whose demand and energy consumption is given by a point above that broken line will find the Hopkinson rate cheaper, the other ones the Wright demand rate.

†*Electrical Review and Western Electrician*, Feb. 11, 18 and 25, 1911.

‡Because the "rate surfaces" are planes. See "Rate Representation in Space," by H. E. Eisenmenger, ELECTRICAL WORLD, Nov. 4, 1911.

Electrification Projects in Czechoslovakia

FOUR companies have recently been organized in Moravia, the leading agricultural province of Czechoslovaki, for the purpose of supplying the province with electric power. Plans include the utilization of power from Moravice and Dyje Rivers, says Consul C. S. Winans in a report to the Department of Commerce. Work has already been started on some of the plants. The cost of the scheme is estimated at 225,000,000 Czechoslovak crowns ($6,525,000), and most of the material will probably be purchased locally.

The Residence Consumer—What He Costs and What He Is Worth

Lack of Such Knowledge Prevents Intelligent Development Work—Attitude of Selected List of Middle Western Small City Companies — How Appliance Sales Increase Consumption

A GREAT deal is being said about the central-station commercial problem in convention and committee meetings. The sources of additional revenue open to some central stations, such as those in the big industrial centers, where all sorts of manufacturing industries are concentrated, are almost unlimited. In such sections the possibilities of commercial lighting and residence lighting and appliance loads are big, but smaller perhaps in the proportion of their total revenue-producing possibilities than the industrial loads. In these centers men of experience are available to work out the problem of proper development of all the varied kinds of business.

Unfortunately, from a load building standpoint, the larger area of the country lies outside these congested centers. By far the greater part is agricultural territory where population is limited. The general commercial activities of the central station are those necessary to serve the agricultural community, and such manufacturing projects as do exist are not an important source of load development. In such communities from perhaps 20 to 35 per cent, or at most 50 per cent, of the total revenue can be classed as commercial or industrial, and in some cases, particularly in very small communities, the revenue attributable to this class of business may drop as low as 10 per cent of the total. The direction in which revenue can be developed lies principally in the field of the small consumer and is largely a residential customer problem.

At the convention of the Iowa Section of the National Electric Light Association in 1922 N. T. Wilcox said that the average residential lighting customer yields an annual gross income of about $20, and he went rather fully into the possibility of increasing this revenue through the medium of the electric range and small household refrigerator outfits as well as the smaller appliances. He made the statement then that through the medium of such devices there is the possibility of an annual revenue of more than $100 per kilowatt of station demand. The same possibilities were stressed in this year's convention of the Middle West Division of the National Electric Light Association at St. Louis.

In the various convention and committee discussions there has been evident a decided lack of knowledge as to just what the condition of the residential service is. Fundamentally there should be a knowledge of what it costs to carry the average residential consumer. By this is meant the fixed investment costs and maintenance of all plant equipment employed in this class of service plus the bookkeeping, meter reading and service costs without any charge for kilowatt-hours used.

TABLE I—WHAT THE ORDINARY RESIDENCE CONSUMER PAYS TO THE SMALL-CITY CENTRAL STATION IN THE MIDDLE WEST

Consumers	Average Monthly Kw.-Hr. of Residential Consumers	Average Monthly Revenue	Monthly Cost of Carrying Residence Consumers
48	11.00	$1.94	.....
130	25.00	5.00	.....
150	10.00	1.50	.....
180	15	1.50	.....
181	12.25	1.94	.....
200	33	2.30	.....
206	17.75	2.45	.....
211	.....	1.50	.....
225	.....	2.15	$0.75
248	15	2.80	1.25
564	15	2.50	1.25
619	.....	.....	.....
650	15	.....	.....
664	27	3.75	.....
773	19	.....	0.75
800	.....	2.50	.....
975	10	1.50	0.75
1,000	19	2.04	1.50
1,350	25	2.92	1.25
2,028	24	2.14	1.95
2,029	21	2.06	1.49
2,374	30	3.24	1.50
2,545	19.4	1.87	1.75
2,546	23.8	3.06	.....
3,102	22	2.19	1.65
4,000	17	1.66	0.50 to 0.65
4,555	22	2.00	1.93
5,172	25	2.00	1.00
5,535	32	3.25	1.29
6,091	26.7	2.58	2.26
7,191	45.8	3.11	2.50
10,234	21	1.74	.....
10,438	23	2.30	0.90
11,194	20.3	2.18	2.50
11,510	30	2.25	2.24
101,71			

These figures are taken from replies to a questionnaire on the subject of residential energy sales and revenue sent to thirty-five Middle Western utilities. They reveal a wide variation in monthly average consumption and revenue and indicate a widespread lack of knowledge of the cost of carrying residential consumers. The figures on these costs ranging from $2 to $2.50 per month are those which appear to be based on a careful study. In the majority of cases this sort of cost information is not in possession of utility organizations because no attempt has been made to analyze the costs.

What the Residence Consumer Pays

Table I, which represents nearly 102,000 consumers, is taken from a recent survey made in the Middle West to ascertain if possible what the ordinary residence consumer uses in energy, the revenue that may be expected and the bare cost of carrying a consumer on the system before he is charged for energy. The figures are given exactly as they came from the various companies to show the wide discrepancies that exist for the highest and lowest reported average consumptions on different systems and the apparent lack of fundamental cost knowledge that prevails.

On the systems serving up to 1,000 consumers it seems that there is almost a total lack of knowledge of what it costs to carry a residential consumer. The four figures given are evidently an estimated cost of billing and meter-reading expense. On systems with from 1,000 to 5,000 consumers there is more information, though it is evident that there must be a serious lack of data as to the actual costs, since the discrepancies, after eliminating those that evidently cover billing and meter-reading costs only, is too great to represent a true knowledge of the situation, especially when studied in the light of the figures for systems having more than

5,000 consumers. On these latter systems, after eliminating several which clearly do not contain fixed investment and maintenance costs, costs of carrying residential consumers are given which show a monthly expense of $2.25 to $2.50. Nearly 26,000 consumers are represented in this group.

WHAT THE RESIDENCE CONSUMER COSTS

In Table II are given some cost figures on residential consumers taken from data presented before the 1922 convention of the Northwest Electric Light & Power Association by George H. Davis of the Idaho Power Company and published on page 1398 of the Dec. 23, 1922, issue of the ELECTRICAL WORLD. The cost of carrying residential consumers is given at $2.25 per month, or $27 per year. In the Oct. 28, 1922, issue of the ELECTRICAL WORLD, page 929, in an article by Messrs, Greene, Schoonmaker and Gorton on the allocation of electric service costs, are found residential consumer costs of $1.03 per month and demand costs of $1, or a total of $2.03. While these figures are not based on one specific community, they represent costs that are typical for many communities in Iowa. Another careful analysis covering very small communities on a large Middle West system the name of which cannot be given has shown a monthly cost of $1.20 for consumer and $1.20 for demand costs. This represents small communities containing in the aggregate several thousand consumers fed from a transmission system and the figures were prepared with enough care to render their practical accuracy unquestioned.

It would appear fundamental in dealing with residential business development that there is room for a great deal more work in ascertaining the cost of giving service. There is considerable ground for suspecting that the cost of carrying the average residential consumer on Middle Western properties, outside industrial districts, lies somewhere around $2 to $2.50 per month, or $24 to $30 per year, for all costs except the actual production cost of energy delivered. If this is the case, then the average revenues shown in Table I and that indicated in Mr. Wilcox's statement before the Iowa convention show a discrepancy between costs and revenue that is a serious problem and one only aggravated by the addition of such consumers.

The remedy is the development of greater use of energy by the individual consumers. Just how this is to be done is the question around which the present discussion is revolving. The three principal suggestions are: (1) An increase in the size of lamps used and a higher standard of illumination. This has obvious limitations. (2) An increase in the use of the smaller appliances. This again has limitations, although both in the number of appliances in use in a home and in the extent of their habitual use it is susceptible of a very great development. (3) The general adoption of the electric range and refrigerator in domestic service.

A number of companies that have made a definite attempt to increase the use of electric light in the household report considerable progress and benefit. There is a surprisingly large number of customers who buy lamps smaller than the 40-watt size and will continue to do so for many purposes, and there is also a lamentable proportion of empty sockets. Considerable can be accomplished, however, by informing and reminding the public of the advantages of larger lamps and better light, but in communities of this size in this section it is necessary, in order to influence the situation much, to obtain and sustain the co-operation of the local merchants who sell lamps. Lamps are sold in a large proportion of the general stores in small towns, and it is a matter of considerable importance to the lighting company that a working basis of co-operaton be established between all these retail outlets and the utility both for the service of the public and the guidance of lamp selection.

In canvassing this selected list of thirty-five Middle Western small city central stations the direct question was asked: "What special efforts are you making to increase your average monthly residential bills?" One reported that it was pushing larger-voltage lamps primarily, sending men from house to house to repair bad sockets. Another said that it was campaigning on the sale of a kitchen lighting fixture which uses a 150-watt lamp. Several mentioned activity in this field of lighting as a part of a general effort to get more business. Twenty-five companies particularly specified appliances as their chief interest at the moment. The following statements are typical:

1. "Pushing the sale of appliances both in our jobbing department and also by drug stores, hardware stores, plumbing shops, etc., that might sell such appliances in our city."
2. "Holding demonstrations for the sale of electrical appliances, particularly cooking devices."
3. "Promoting the use of grills, small stoves, percolators, washing machines, cleaners, etc. Most customers now have flatirons."
4. "Pushing the sale of appliances of all kinds."
5. "By maintaining a free inspection service, following the regular meter routes, we are able to sell and demonstrate the use of appliances and better lighting. These appliances are carried in an electric truck as a base."
6. "Sending men to homes of consumers to make minor repairs to appliances and ascertain just what they have, so we may know where to push lamps and appliances."
7. "Having our salesmen concentrate on revenue-producing appliances. Considering developing an electric home for display purposes."
8. "Pushing electrical appliances in general and making special effort on ranges."
9. "Selling ranges, washing machines, irons, sweepers, electric incubators, etc."
10. "We have built a model electric shop and have a low cooking rate and make a special effort to develop this business by selling electric ranges at cost and donating the wiring. Electric cooking, we believe, offers the biggest chance for expansion in the residence field."

Two companies made a particularly interesting report on their experience in the sale of electric ranges, which will be made the substance of a further article. They are successfully concentrating on the development of a range load, considering it their most promising opportunity.

BILLS LARGE ENOUGH

Letters were also received from ten other companies reporting no effort to increase business. These are interesting, too, as indicating a lack of appreciation on the part of some central-station executives that the unit of residence business is, after all, the home and that every household is susceptible to the appeal of electric service if its many diverse benefits are adequately interpreted. One man says in answer to the same question ("What effort are you making to increase residence bills?"): "None. Feel that bills are large enough. Irons and lights are about all the small-town man can use electricity for to advantage in his residence. Believe it more satisfactory to get more customers than to run bills up on present consumers." Yet it is surely a fact that floors must be swept in the small-town home, and clothes must be washed, and coffee is made, and toast also, and baby bottles are warmed, and a cool

breeze is as much enjoyed as in any dwelling in the large city. Moreover, the small-town man has money which he is quite as glad to spend on the things his family needs and wants, as is evidenced by the number of automobiles that are owned in every village, and there is a considerable proportion of them that are medium-priced or expensive cars. The families that use these cars should certainly buy electrical appliances if they are properly sold.

Another company writes: "None. Rates as low as we can possibly make them to the customer on our investment." The assumption here seems to be that the only way to sell more service is to cut the price. But the small-city public does not buy these things on price or it would buy transportation only in the form of Ford cars. With the low rates obtaining in this town there should be no obstacle to the sale of more and more appliances and better and better light until the houses are all completely equipped and properly illuminated.

Several other companies report no capacity, and the rest simply answer that they are doing nothing to build up business. The predominant note for the entire list, however, is optimism and confidence, and no man can doubt that all of them will recognize the opportunity.

TABLE II—COST OF CARRYING RESIDENTIAL CONSUMERS
(Presented by George H. Davis, Idaho Power Company, at the 1922 Convention of the Northwest Electric Light and Power Association.

Annual generation, transmission and transformation costs	$14.25
Annual distribution costs	5.25
Annual customer costs	7.50
Total annual costs	$27.00
Average per month	2.25

Just what can be accomplished in increasing residential consumption by introducing larger lamps and by the sale of more appliances is shown in the series of curves herewith. These four curves are taken from the records of a Middle Western transmission system and embrace twenty-nine towns ranging in size from about 80,000 to less than 1,000 population. On this system special attention is paid to the merchandising of appliances from the central-station salesroom and also to the encouragement of the independent dealers to do a better merchandising job and become more prosperous. Every town where an office is maintained has a display room appropriate to the size of the town, and no reasonable expense is spared to make it the most enterprising and attractive electric shop in town. Sales campaigns are carried on from time to time in which seasonable appliances are pushed. These campaigns are not heavy, whirlwind selling ventures, with a slump between times, but a steady, consistent effort in which the particular articles featured are varied to suit the season of the year.

These curves are typical for the entire system, being selected to show the results for the largest, the medium and the small-sized communities served. The records extend back to 1917, and the monthly average kilowatt-hour consumptions for 1921 and 1922 are available. The average monthly consumptions since 1917 have increased between 50 and 100 per cent for all the communities that have been served during that period. The appliance load involved consists mainly of the smaller household equipment, and with all that has been accomplished it seems fair to question whether these devices alone are of sufficient energy-consuming capacity to bring the average to a point where the residential service ought to be.

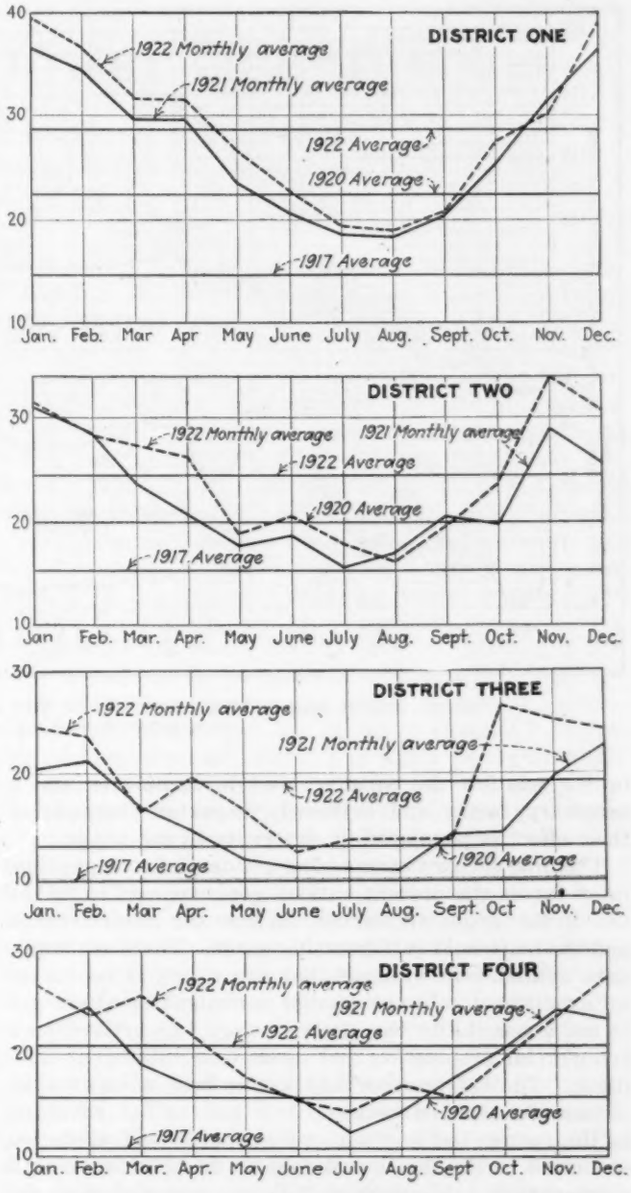


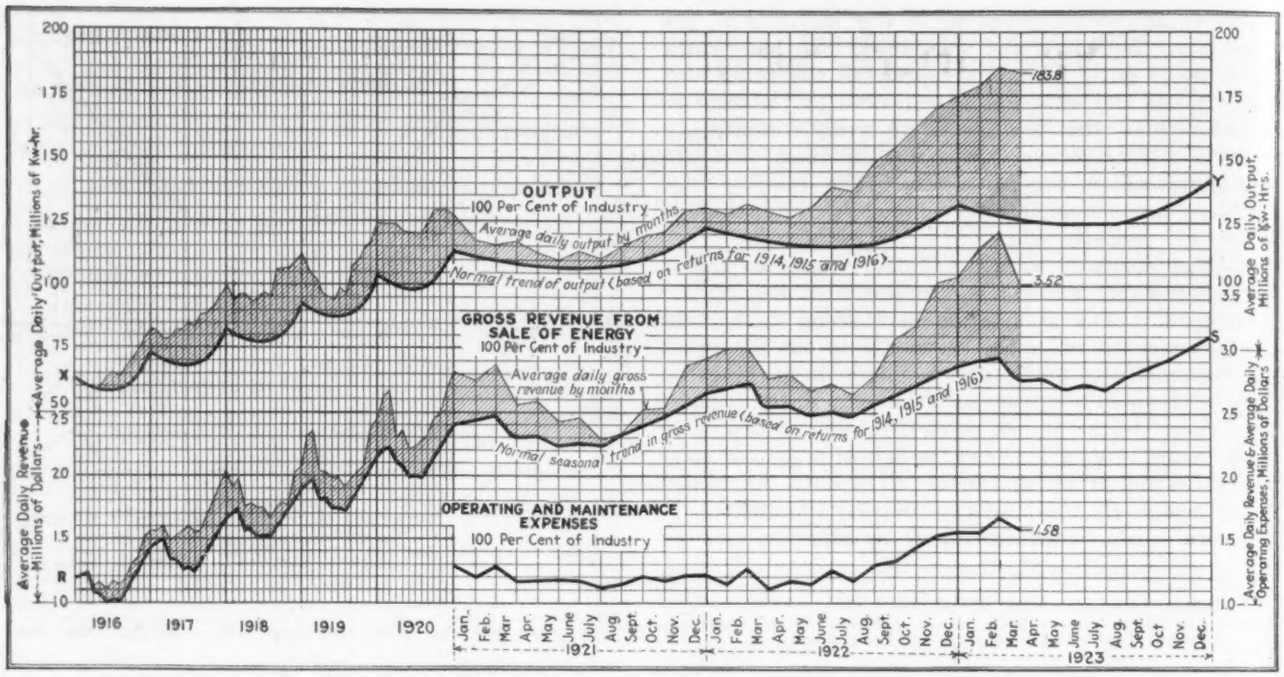
FIG. 1—RESULTS FROM INTELLIGENT EFFORT IN PROMOTING BETTER RESIDENCE LIGHTING AND SALE OF APPLIANCES

District 1 is for a city of 80,000 population, District 2 for one of 10,000, District 3 for one of 1,500 and District 4 for one of 1,100.

This statement in no way questions the value of ordinary appliance sales, but merely points the fact that usage is such that the smaller appliances alone are not a solution of the problem. They provide a profitable load whose importance is tremendously enhanced by their effect in popularizing electricity in the home. Opinion, however, seems to be steadily strengthening that adequately to solve the residential service problem more attention must be given to the electric range.

Two Chief Factors

To sum up the principal factors in the present discussion of the Middle Western smaller central-station situation as it affects the residential customer, it seems fair to question, in the first place, whether there is an adequate knowledge of the bare cost of handling such consumers, and without this knowledge no really intelligent means of solving the problem can be devised.


OUTPUT
100 Per Cent of Industry
Average daily output by months
Normal trend of output (based on returns for 1914, 1915 and 1916)
183.8
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
Average daily gross revenue by months
Normal seasonal trend in gross revenue (based on returns for 1914, 1915 and 1916)
3.52
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
1.58
Average Daily Output, Millions of Kw-Hr.
Average Daily Revenue, Millions of Dollars
Average Daily Output, Millions of Kw-Hrs.
Average Daily Revenue & Average Daily Operating Expenses, Millions of Dollars
1916
1917
1918
1919
1920
1921
1922
1923

DURING MARCH THE CENTRAL STATIONS OF THE COUNTRY SOLD A TOTAL OF 5,690,000,000 KW.-HR., OR A DAILY AVERAGE OF 183,812,000 KW.-HR.

in its solution the smaller electric appliances are a necessary factor and extremely important because of their effect in popularizing electricity in the home.

The final factor in increasing residential consumption, in as far as the present outlook goes, appears to be the use of the larger appliances, such as the electric range and the household refrigerating outfit. There are ample data available to indicate that the range is no longer an experiment. In the smaller communities where gas is not a possibility the electric range has arrived as a commercial proposition and needs only intelligent handling. The refrigerator has so far been somewhat an object of suspicion because it is not so far advanced as the range; but one unusually capable central-station executive in the Southwest told an ELECTRICAL WORLD representative this spring: "We are satisfied that the refrigerator has arrived. This year we will put all our energies behind it and expect to influence our residential sales materially."

Record Output During March

REPORTS received by the ELECTRICAL WORLD for the month of March from central generating and distributing companies representing 72 per cent of the installed generator rating of the country indicate that a new output record was established by the industry during the month.

The average daily output during March was 183,812,000 kw.-hr., which was slightly below the record figure set during February. However, the total output for the month of March was 5,690,000,000 kw.-hr., which was about 160,000,000 kw.-hr. in excess of the previous record figure set during January of this year. This was the first instance in the recent history of the industry in which the operations during March have exceeded the previous December, January and February. In the first quarter of the year the central-station companies of the country sold a total of 16,400,000,000 kw.-hr. of electrical energy, which was 27.8 per cent over the amount sold during the first quarter of 1922. Such operations point unmistakably to the most prosperous year in the history of the central-station industry.

The average daily revenue from the sale of energy during the month was $3,522,000, which was $402,000 under the record figure set during February. The total gross revenue for the month was $49,100,000, which was about $300,000 below the record figure for revenue set during January. The total gross revenue for the first quarter of the present year was $149,200,000, as against $119,000,000 for the first quarter of 1922, or an increase of 25.2 per cent. If these percentage gains in output and revenue were to continue throughout the year, the indications would be that the output of the industry is doubling about every three and a half years and that the revenue doubles about every four years. Given the proper background of general industrial prosperity, there is no doubt that this rate of growth will continue for several years to come.

CENTRAL-STATION RETURNS FOR THREE MONTHS

Mos.	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting) 1923 Thousands	1922 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting) 1923 Thousands	1922 Thousands	Per Cent Increase
Jan....	74	4,095,895	3,176,836	28.9	68	$79,892	$67,683	18.0
Feb....	72	3,735,830	2,918,625	28.1	68	74,709	61,838	20.8
Mar....	72	4,102,725	3,237,221	26.8	68	74,308	61,518	20.8

Mos.	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies Reporting) 1923 Thousands of Dollars	1922 Thousands of Dollars	Per Cent Increase	OPERATING RATIO Steam Plants 1923	Steam Plants 1922	Hydro Plants 1923	Hydro Plants 1922	Combined Systems of Steam and Hydro 1923	Combined Systems of Steam and Hydro 1922
Jan....	56	$27,706	$22,904	21.0	47.3	45.3	23.8	23.4	45.3	43.1
Feb....	56	26,147	21,521	21.5	46.0	46.1	24.0	26.6	42.0	41.2
Mar....	56	27,499	22,323	23.2	44.0	48.3	23.6	27.1	40.0	40.7

National Superpower Scheme

Frank G. Baum, After an Extensive Study and Survey of the Power Resources of the Nation, Outlines a Constant-Potential Transmission System of Immense Magnitude

READERS of the ELECTRICAL WORLD are familiar with the superpower survey made by the United States Geological Survey in the district extending from Boston to Washington. A much larger survey, nation-wide in its scope, has been completed by Frank G. Baum, well-known consulting engineer of San Francisco, whose most recent accomplishment was the Pit River development of the Pacific Gas & Electric Company. Mr. Baum has divided the country into twelve regional power districts, all of which would be interconnected to obtain the greatest possible benefits from diversity, service, insurance, etc. The main features of such a system are given here: Mr. Baum in his "Atlas of U. S. A. Electric Power Industry," now in press, gives a wealth of supporting data from which his conclusions are drawn.

On page 1274 are shown the suggested regional electric power districts and proposed main routes for lines representing such a national power system. For some of the Eastern states a system of this kind has been very much needed. The reasons which led Mr. Baum to choose the routes indicated are given by him as follows:

"Lines to be built from the Adirondacks to New York with a connection to District 1 are shown, in view of the New England States being short of water power. District 1 may in addition in time get some water power from Canada, and two proposals for bringing power from Canada are now under consideration. From the Adirondacks the line would finally extend back to the St. Lawrence water power. A second line would be required to take the St. Lawrence power to New York, and this could be from the St. Lawrence River southerly toward Utica and then to the metropolitan areas. In time two tower lines over each route to carry a total of 1,200,000 kw. may be required for the Adirondack and St. Lawrence power.

"A line is shown extending from Niagara Falls southeasterly to the metropolitan area and connecting southerly through the Susquehanna River region with the Susquehanna power at Holtwood and the Niagara power and the St. Lawrence power, interconnected as shown, through Philadelphia and the industrial regions of eastern Pennsylvania west of New York. From Niagara a second line is shown extending westerly to Erie, Cleveland and Toledo, connecting with the power systems of Michigan and going westerly, finally connecting with the large steam plants on Lake Michigan. The two lines from Niagara would require 600,000-kw., 60-cycle power, available at Niagara. Steam reserve for District 2 may come from District 5 over the connecting lines shown. This will result in great savings of anthracite coal and reduce rail transportation of coal over the Allegheny Mountains.

"A line is shown in district 5 extending westerly from Pittsburgh to Columbus, Dayton (connecting with Indianapolis), Cincinnati and Louisville. This is an easterly and westerly high-tension power route to which available water-power and large steam-power stations should supply their output. Some water power can be delivered to the Pittsburgh district by power lines from branches of the Allegheny, Monongahela and Youghiogheny rivers. A line is shown running southeasterly from Cincinnati and from near Columbus, Ohio, to Charleston, W. Va., and thence over the Appalachian range, connecting with the system of the Southern Power Company. The upper Kanawha River and the New River can be developed to yield quite a large amount of water power, sufficient to justify a double-circuit, 220,000-volt transmission line. Along the Kanawha and New Rivers there could also be large steam plants using the coal of this region. This line would serve a very valuable function in feeding power into District 5 and also acting as a steam reserve plant to District 3 for the systems east of the Allegheny Mountains. District 2 may finally get some steam power from this region.

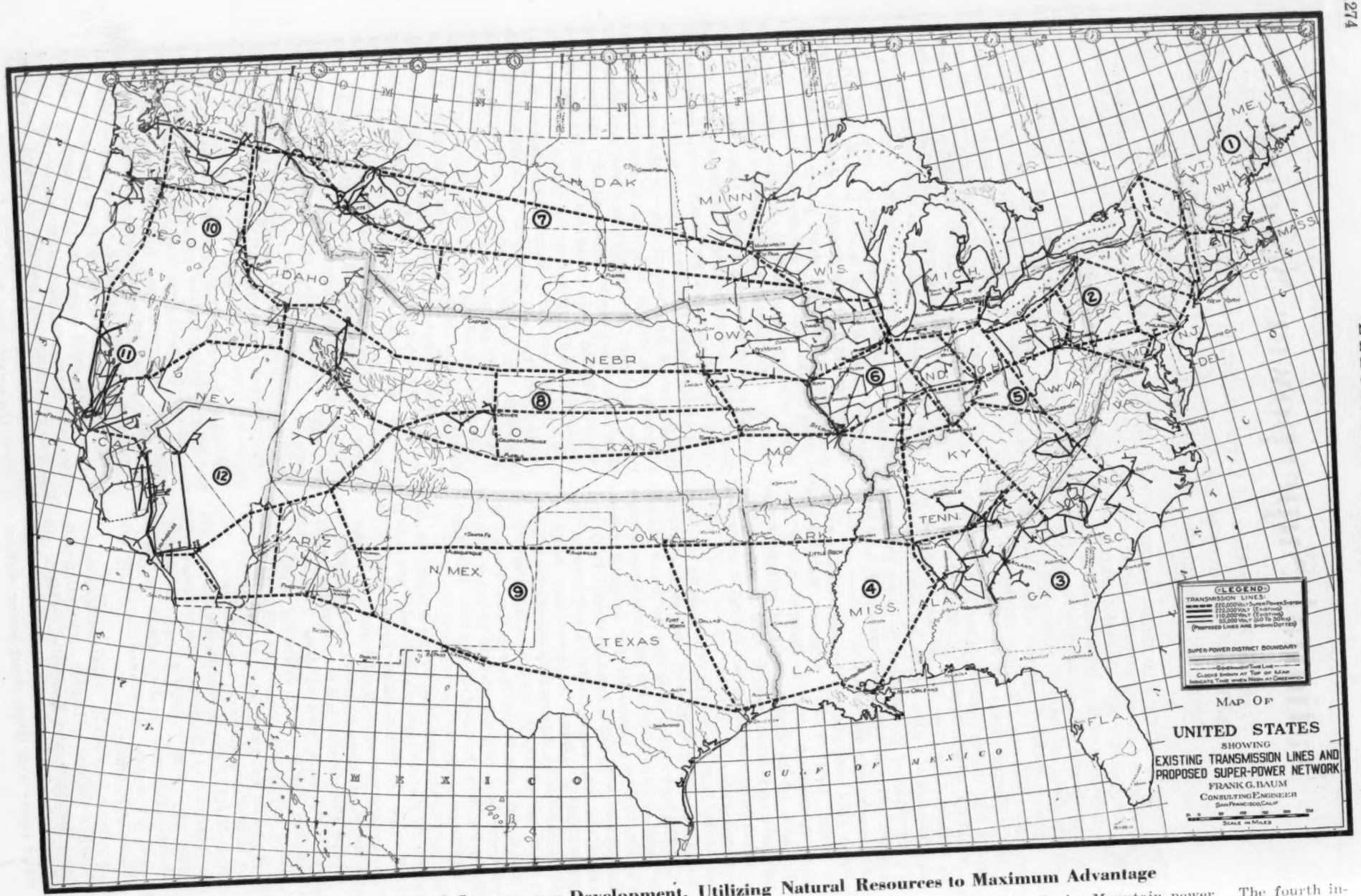
"No 220,000-volt lines are shown in District 3 except those bringing steam reserve and water power over the mountains from Districts 5 and 4. From Louisville, extending southeasterly, another trunk line is shown, going to the branches of the Tennessee River, where a considerable amount of water power can be developed. It is probable also that steam plants could be located on this line and a line connected across the mountains for reserve to the systems in District 3, east of the Appalachians, as shown. Another line is shown extending from Muscle Shoals northerly, to connect with the trunk line to Louisville and St. Louis, as this seems the best means of disposing of this power at this time.

"It would seem logical that the Muscle Shoals power should finally be used largely in District 4, but it will take some time for this market to develop, as outside of Alabama no large market is now available. But with the reclamation of the lower Mississippi, which contains the largest undeveloped land area in the United States, large amounts of power will be required, and I have therefore shown the Muscle Shoals lines as running westerly across the Mississippi near Memphis and southerly to New Orleans, and westerly from New Orleans into Texas, connecting with the power lines finally to be built to supply Region 9 from the power of the lower Colorado River and power developments in Texas and Oklahoma. Some of this power could be developed from the waste gases of the oil fields. The lines radiating in eastern Oklahoma are to take away the power from the gas fields.

"District 6 is largely a steam-power district, which may be used to balance the water power flowing toward this district from all directions. Fortunately District 6 has large coal resources. District 6 may finally get some water power from Minnesota and Manitoba.

"From the power available on the upper Missouri River and its branches trunk lines are shown going easterly which could supply the three northern railway routes with power for electrification, one main power line going to Minnesota and St. Paul and connecting finally with Milwaukee as shown.

"From the upper Colorado River three lines are shown



Baum Plan for National Superpower Development, Utilizing Natural Resources to Maximum Advantage

Four main power problems confront the industry. One is the development of water powers and supply of markets in District No. 2. The second involves the same problems for District No. 5. The third is to find a market for Rocky Mountain power. The fourth involves the same problem for District No. 10.

going easterly, one along the route of the Union Pacific, another along the route of the Santa Fé, the third being intermediate.

"In the Pacific Coast states, in District 10, the market conditions have not yet developed sufficiently to determine all the main trunk transmission routes. Districts 11 and 12 have already 220,000-volt lines, which are shown as part of the entire system as outlined. The new plant being built on the Tuolumne River for San Francisco should connect the 220,000-volt lines of District 11 with those of District 12 as indicated. This is a practical example showing the value of such a transmission system.

"It is thus seen that there are four main power problems confronting the industry. One is to develop the water powers and supply the markets of District 2. The second is to develop the water powers on the Ohio River drainage to supply the markets of District 5. The third problem is to find a market for the power in the Rocky Mountains, and it seems that this latter must be done largely by taking the power easterly along the railway routes as shown. (This problem of taking the surplus power from the Rocky Mountains to the Mississippi Valley may require in the future 330,000 volts, but initially 220,000 volts will suffice.) The fourth problem is to find a market for the very large amount of water power available in the states of District 10—Washington, Oregon and Idaho—and in this region should be located at various points some large power-using industries, such as are now near Niagara. All of these problems require for their best solution large-capacity transmission systems."

Superpower as a National Policy*

Not Engineering Obstacles but Legal, Political and Financial Difficulties Stand in the Way of Vast Interstate Networks—Mining and Railroad Loads Waiting—Civilization and Superpower

By M. H. AYLESWORTH
Executive Manager National Electric Light Association

THE idea of bulk supply is not new. It is as old as the electric lighting industry itself. From the very beginning it was recognized that the economics of the situation demanded that the supply of electricity for the home, for the store, for the factory and for transportation come from one central source. Superpower is merely an elaboration of the central-station principle making for the greatest possible economies and conservation and enabling the electric light and power industry to keep the price of its service constant in the face of enormous increases in the cost of labor, fuel, equipment and supplies.

Considering the numerous and marked advantages which accrue from superpower stations and systems, and the desire of the electric light and power industry to engage in a progressive and far-reaching program of expansion, one is naturally surprised that the number of superpower stations in existence is not larger. Certainly it is not for want of vision on the part of the industry, nor yet for want of load. Our companies have great difficulty even in normal times to keep abreast of demands for service, and they are erecting and will erect superpower stations just so fast as financial and economic conditions warrant and handicaps are brushed aside. It is a matter of great national interest, however, whether the billions of horsepower-hours produced in this country shall be produced at an expenditure of six pounds of coal per horsepower-hour in a small plant or one pound of coal in a superpower station. It is also a matter of public concern whether we shall continue to be prodigal in the utilization of our fuel resources and at the same time permit our water powers to run to waste.

LEGAL DIFFICULTIES

According to the second annual report of the Federal Power Commission, applications have been made for licenses for the development of an aggregate of 20,000,000 hp. on lands over which the federal government has jurisdiction. This is twice the water power which has been developed in the United States to date and is from five to six times greater than the aggregate of all applications filed with the federal government since hydro-electric development became an art. Obviously the inclination and desire to develop water power in this country has not been lacking; the right to do so under reasonable legislation has only just been granted.

Now, the source of half the power represented by the applications in the hands of the Federal Power Commission is found in three rivers, the St. Lawrence, the Colorado and the Columbia, and every one of these streams is at present involved in legal entanglements. The St. Lawrence, for instance, is an international boundary stream, and until a treaty with reference to its greater canalization and control is negotiated between the United States and Canada no American water-power projects of any magnitude can be undertaken.

The Colorado River is involved by a compact signed in Santa Fé, N. M., last November. This compact must be ratified by the seven interested states—all but Arizona have already signed—and then by the National Government. The treaty between the states allocates the water of the Colorado between the geographical divisions and provides for flood control, irrigation and power development. Thus far the Federal Power Commission has taken no final action on the applications involving this stream, and it is not likely to do so until some unity of action is agreed on by the States of California, New Mexico, Nevada, Utah, Wyoming, Colorado and Arizona.

The Columbia River has been under investigation by a special board to determine the relation between water power, irrigation and navigation, and for these reasons action on almost all the projects on that river has been suspended for the time being.

To cap the climax, the State of New York has brought suit in the United States Supreme Court to have the federal water power act of 1920 and the activities of the

*Part of an address made before the Pittsburgh convention of the A. I. E. E., April 25, 1923.

Federal Power Commission thereunder declared unconstitutional. Already Pennsylvania and seven Western states have announced that they will fight the suit, and it is not unlikely that in the end as many as forty states may appear against New York. Annulment of the federal water-power act would produce a chaotic situation in Western states, where much hydro-electric development has begun under it, and would open the way to further selfish state discrimination such as now obtains in the State of Maine. Until, therefore, the federal law is upheld by the United States Supreme Court, all permits issued by the Federal Power Commission are under a cloud, and because of that fact very little money will be available for water-power development. It is just as difficult to sell bonds on a hydro-electric property thus encumbered as it is to raise a mortgage on real estate the title to which is not clear. Other superpower streams, like the Delaware, also are involved in legal controversies, and until these are settled many hydro-electric superpower projects will be effectually checked.

It will be recalled that the United States Geological Survey made an exhaustive study of the Boston-to-Washington power zone and brought to light the enormous economies procurable through a proper co-ordination of steam and water-power resources in the district. Were it merely a matter of engineering, the recommendations of W. S. Murray and the other engineers who made the survey would now be carried out; but legal and financial difficulties are not easily disposed of. As it is, the plans laid down in that report are already being carried out in part through the natural evolution of the business.

The electric light and power companies are not pessimistic over the outlook. On the contrary, they are going right ahead with characteristic enthusiasm and optimism, building huge stations here and extending transmission lines there in spite of handicaps. The road is not strewn with roses, however, nor do the handicaps always go down before a frontal attack. More often they necessitate a long siege.

National Aspects of Superpower Supply

Manifestly, if we are to maintain the high standard of living which is characteristic of America, the per capita earnings of the country must also be high. The United States, through its great use of machinery and electricity, is able to maintain a higher standard of living than any other country because its labor produces more and earns more. During the twenty years prior to the war, the annual national per capita earnings in the United States increased 116 per cent, those of Germany 52 per cent, France 27 per cent, and Great Britain 21 per cent.

These percentages reveal much. They show what an enormous influence cheap power, which means electricity, has on the productive capacity of a nation and people, and it is chiefly because they are such great users of electricity that Americans excel in so many directions. But if we are to continue to enjoy an abundant and cheap supply of power, we must concentrate more and more in its production; we must erect fewer but larger stations; we must develop our water powers, conserve our fuel resources and through interconnected networks of transmission lines make power available in every market.

Thus the water power of the Sierras will be the mainstay of industry on the Pacific Coast; the Rockies will provide sufficient power for local needs and large blocks of energy ought to find their way into the prairie states far to the east; the Middle Atlantic and New England States must look for hydro-electric developments on the Niagara and St. Lawrence Rivers to augment their supply of energy, the watersheds of the Southern Appalachian range ought to provide additional power for the states bordering on the Ohio River in addition to meeting the fast-growing needs of the South.

Economic Advantages of Water Power

There are in existence numerous examples of electric superpower stations and systems which have not only justified the faith which the electrical industry has in them but have also proved their value to the nation and to its industrial development. A romance could be written around the use of hydro-electric energy by the electrochemical industry at Niagara Falls, and one of the most interesting chapters could be devoted to tracing the use of those electrochemical products manufactured through the instrumentality of cheap electricity in the thousand and one essential industries scattered throughout the country. It would be vain to dilate on the application of electricity in California and what hydro-electric development means to it. It is an open book, and the story can best be told by a citizen of that state.

The Montana Power Company furnishes 85 per cent or more of all the electricity used in the State of Montana. This energy is derived from numerous hydro-electric stations which are interconnected and which feed high-tension transmission lines traversing the greater part of the State. The mining and production of copper is the chief industry of Montana. Before the present hydro-electric stations on the Missouri River were built the mines of Butte and the smelters of Anaconda were depending on steam power to the extent of 35,000 hp., and it was costing them on an average $85 a horsepower-year. Hydro-electric energy was transmitted into the district from Great Falls, 130 miles away, and sold to the mines at $30 a horsepower-year. In other words, the mining companies were enabled to carry on their operations for $2,000,000 less money a year than it cost before. But the most significant fact of all is that this cheap electric power made it commercially porfitable to refine and reclaim tens of millions of tons of low-grade copper ore that otherwise would have had to be passed by—and the United States is the largest producer of copper in the world.

The question of transportation is one of the most active in the national mind today, and in its solution the electric light and power companies will play a most prominent part. As indicative of the savings which electrification makes possible, the case of the Chicago, Milwaukee & St. Paul Railway, which receives electricity for operating its transcontinental line from central-station sources, may be cited. At the time the Milwaukee road was electrified a long-term contract was made with the Montana Power Company for power to be delivered over 450 miles of the road. The cost of the electricity was something like $550,000 a year, whereas, although the Milwaukee railroad furnished its own coal from its own mines and one-third of its equipment was used in hauling the coal, the cost of the coal to operate the steam trains over the same section that was afterward electrified was approximately $1,750,000 a year. The same power company provides electricity for the Butte, Anaconda & Pacific Railroad Company at the same price and practically under the same conditions as it does to the Chicago, Milwaukee & St. Paul Railway Company. The cost of electrical energy

for the Butte, Anaconda & Pacific Railroad Company a year after its electrification was $8,000 a month, whereas it formerly cost the railroad $22,500 a month for coal alone.

Aside from the advantage which accrues to every shipper over these railroads owing to the more dependable and cheaper electric power, such an arrangement possesses other marked advantages. It saves coal in the ground and utilizes an absolutely waste product—water power—which until recently was permitted to flow unmolested to the sea. It also contributes not a little to the growth of the state because it enables industry to locate in the territory and assures it of low-priced power anywhere along the line of the railroad.

The acquisition of a large amount of railroad load is especially beneficial to electric public utilities in that it makes for cheaper operation in direct proportion to the volume and diversity of the business, and this in turn means cheaper money and lower rates to the consumer. It is the experience of every public utility operator that under regulation the only way to be successful is to follow the modern plan of big volume and small margin. For purely economic reasons little plants and distributing systems and little companies in the electric public utility field have gone forever. Even in the case of the great steam-railroad systems of the country, traversing as they do many states, it has been found that the best interests of the public as well as the railroads lies in still greater consolidation of railroad groups under a single management.

CIVILIZATION AND SUPERPOWER

Superpower is a measure of advancing civilization. It is machinery raised to the *n*th degree, superseding municipal and state boundaries and becoming national and continental in its character. It can find no abiding place in countries where life is primitive and labor cheap. A superpower system in China or India, for instance, would manifestly be a wild extravagance. The simpler manufacturing processes, the only ones that are performed in primitive countries, are in those lands more economically carried on by man power than they could be through the use of electrical energy, even at a rate that will barely pay interest on the cost of setting up the generators and building the transmission lines. But, as civilization grows in backward nations, the demand for machinery will grow, and a time may come when progress will not only bring with it the multiplication of steam and hydro-electric stations, but will cause their energy to be carried for scores or hundreds of miles to supply light, heat and power to every district and to turn the wheels of innumerable factories.

In America that day has already come. Electricity is demanded in ever-increasing quantity. Kilowatt-hour output grows by leaps and bounds. It is becoming a matter of common knowledge that to build a central station in every little town is as wasteful as it was to install a plant in every building. The individual plants once so numerous will soon be almost things of the past. So, too, will the small central stations, disadvantageously situated, disappear as the economy of service from greater stations, built near mines or on water-power sites, becomes more and more apparent. Interconnection, already a proved boon to consumers in economy of rates and reliability of service, will extend until the isolated system becomes a rarity, and over all parts of the land networks will be built offering power to every user at a rate relatively far less than he would otherwise pay.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Relays on the West Penn System

To the Editors of the ELECTRICAL WORLD:

In the May 5 issue of the ELECTRICAL WORLD, in the report of the A. I. E. E. convention in Pittsburgh, page 1029, the report of my remarks in the discussion on relays is slightly in error in other ways besides the prefix of wrong initials to my name. I am made to say that the voltage-restraining relay scheme on the West Penn system was discontinued on account of the purchase of properties equipped with other relay schemes. This is not correct. The reason for discontinuing the relay was the growth of the system, involving additional generating plants and a multiplicity of loop connections. It is further stated that I advocated test of all relays in the laboratory before installation, but this is not the case. My statement was to the effect that many companies are adopting this scheme of laboratory test before installation, whereas out of a total of approximately 600 relays installed within the last two years not more than ten have been in our laboratory, and that our present program allows the relays to be shipped direct from the factory to the job, where they are installed on panels and tested in place.

H. A. P. LANGSTAFF,
Relay Engineer.

West Penn Power Company,
Pittsburgh, Pa.

Transmission Towers

To the Editors of the ELECTRICAL WORLD:

Your editorial of May 19 commenting on the diversity of tower design is extremely pertinent. It can hardly be possible, however, to standardize designs when there is no universal acceptance of loading conditions. The most important of the various test loads, that corresponding to one or more broken wires, is variously estimated by different engineers as equal to (a) the maximum wire tension plus 35 per cent for safety factor and allowance for impact, or (b) the maximum wire tension, or (c) the maximum wire tension less 30 per cent to allow for the reduction in stress when the insulator string swings into line with the wire, or (d) 3,000 lb., being the maximum load which the suspension clamp will carry before it slips.

If a wire is strung for a maximum tension for 5,000 lb., then the broken-wire load on the cross-arm may be variously estimated as (a) 6,750 lb., (b) 5,000 lb., (c) 3,500 lb., or (d) 3,000 lb.

For strain and anchor points (c) and (d) do not apply, but for suspension towers each and every one of the above assumptions is used in different locations, according to the opinion of the engineer concerned. Obviously they cannot all be right, and either the towers are far too heavy with assumption (a) or far too light for condition (d).

With the present widespread use of heavy conductors, especially of steel-cored aluminum, strung with a maximum tension of between 5,000 lb. and 8,000 lb., a more uniform and satisfactory method of estimating the broken-wire load is called for. ERNEST V. PANNELL.

New York, N. Y.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Testing Transformer Polarities

THE proper connection of instruments and relays with potential and current transformers necessitates polarity marks on the primary and secondary side of transformers. This applies to distribution transformers also, aiding the linemen to make proper connections.

Manufacturers as a rule check the instrument transformers and mark the proper polarity at primary and secondary terminals. This work is often checked by the purchaser, and in case of errors the mistakes are corrected. Distribution transformers are often supplied with the statement of "subtractive polarity," and if polarity marks are preferred a proper check is necessary to prevent any mistakes in marking.

In order to check up polarities of transformers by a simple and quick method an instrument was constructed by the writer which consists of a 3-0-3-volt differential voltmeter to be connected across the secondary terminals of the transformer under test. A battery of three ordinary dry cells in series is connected to the primary terminals of the transformer with a push-button making and breaking the current contact.

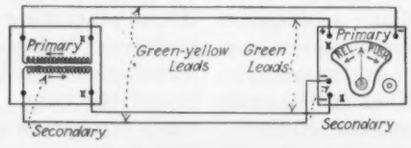
The instrument with batteries, terminals with polarity marks, push-button and leads is mounted in a wooden box. Its weight complete is 18 lb., and the dimensions are 11 in. x 9 in. x 7½ in.

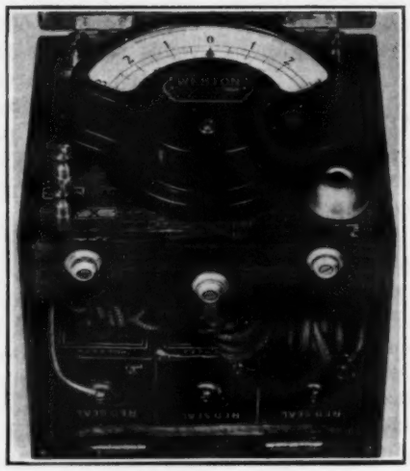
The instrument shown in the illustration is not a standard instrument, on account of its 3-0-3-volt scale. However, it is not necessary to have this scale range. Any scale up to 10 volts can be used, but for a larger scale higher-battery voltage is necessary, thus increasing the size and weight of the apparatus.

An instruction sheet placed in the cover of the testing apparatus gives the operations to check polarity. These instructions are given below the accompanying diagram. The different-colored leads are used to simplify the hook-up and to prevent any mistakes being made by the inspectors. An approximate cost list of materials is given in the accompanying table.

PRICE OF MATERIALS USED IN POLARITY TESTING SET

Bill of Material	Price
One box, with hinges, etc...	$5.00
Three dry cells, at 45 cents.	1.35
Four binding posts, at 10 cents	0.40
Four name plates (primary, secondary and two blanks)	0.16
One carrying handle	0.50
25 ft. lamp cord at 3 cents.	0.75
One differential-scale voltmeter, 3-0-3 volts	15.00 to 30.00
One bakelite panel, 8½ in. x 7 in. x 3/16 in.....	1.80
Total cost	$24.96 to $39.96





APPARATUS FOR DETERMINING POLARITY OF TRANSFORMERS

Connect green leads to the terminals with polarity marks and green-yellow leads to remaining terminals of test set. Connect the leads from primary terminals of set to the high-potential side of transformer, and from secondary to the low-potential side of transformer. Push the button; deflection should be low and to right-hand side of scale. After the pointer returns to zero release the button; deflection should be high and to left-hand side of scale. Then the polarity marks should go to the terminals of the transformer, where the green (polarity) leads are connected. If the deflections are reversed as compared with the above, reverse either primary or secondary leads at transformer terminals and repeat the operation. In cases where the deflections are too small, connect primary terminals of set to the low-voltage side of transformer and secondary terminals of set to the high-voltage side of transformer.

East Orange, N. J. E. J. MOMMO.

Foundry Flasks Repaired by Arc Welding

ONE of the most recent applications of arc welding in foundry practice is that of repairing worn flasks. This operation is proving to be such a success and to bring about so marked a saving that all foundry superintendents should learn how to take advantage of the process to help reduce their foundry expenses.

After use, the malleable iron lugs of the flasks become worn to such an extent that the pin on the other half of a flask will not fit in it tightly enough to hold the parts in alignment. The method of making repairs in the past was to ream out the hole to a diameter of ⅞ in. and then press in a bushing having a ¾-in. hole. When the bushing wore too large it was replaced with a new bushing.

The new method of repair, however, is even less expensive and much more satisfactory. The practice is to ream out the hole to ⅞ in. diameter and then fill the hole completely, using the metallic electrode arc-welding process. A piece of copper is placed under the hole and the welding is done, using about 175 amp. and a 5/32-in. welding wire. The time required to weld one hole is about three minutes. When these holes are again worn too large it is not necessary to ream them out before the welding operation. The time required to weld a hole is then reduced to about two minutes.

The cost of welding each hole as originally drilled to ⅞-in. diameter is about as follows:

Labor, at 70 cents per hour.....	$0.035
Welding wire, at 8 cents per pound.....	0.016
Electric power, at 3 cents per kw.-hr.....	0.013
Total.....	$0.064

A question naturally arises as to why it is necessary to drill a ⅞-in. hole in the casting when only a ¾-in. hole is required. The reason for this is that there will be a layer of very hard chilled high-carbon cast steel about 1/16 in. thick in the region where the deposited metal unites with the casting; therefore it is necessary to

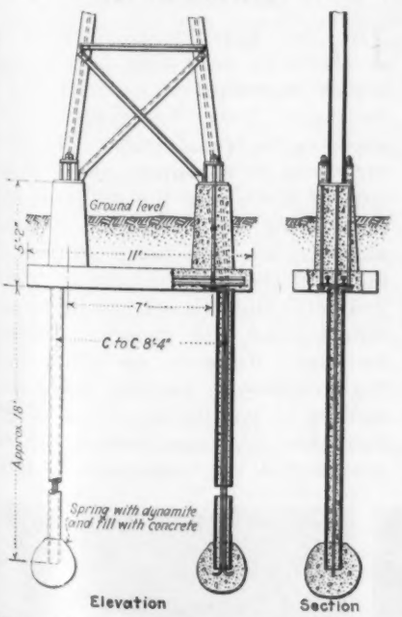
have the original hole ¼ in. larger than the final hole so that no difficulty will be experienced in drilling the final hole through the deposited metal.

A. M. CANDY,
General Engineering Department.
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

Steel Towers Illustrate Interesting Design

AN ANCHORAGE for transmission-line towers described by A. W. Malone in the ELECTRICAL WORLD of March 3, 1923, page 524, recalls a similar design used ten years ago by the Isthmian Canal Commission in the construction of a 44,000-volt transmission line for the Panama Canal. Mr. Malone's anchorage for transmission line towers consists of a drilled hole with a dynamite-sprung bottom, filled with concrete embedding a steel anchorage.

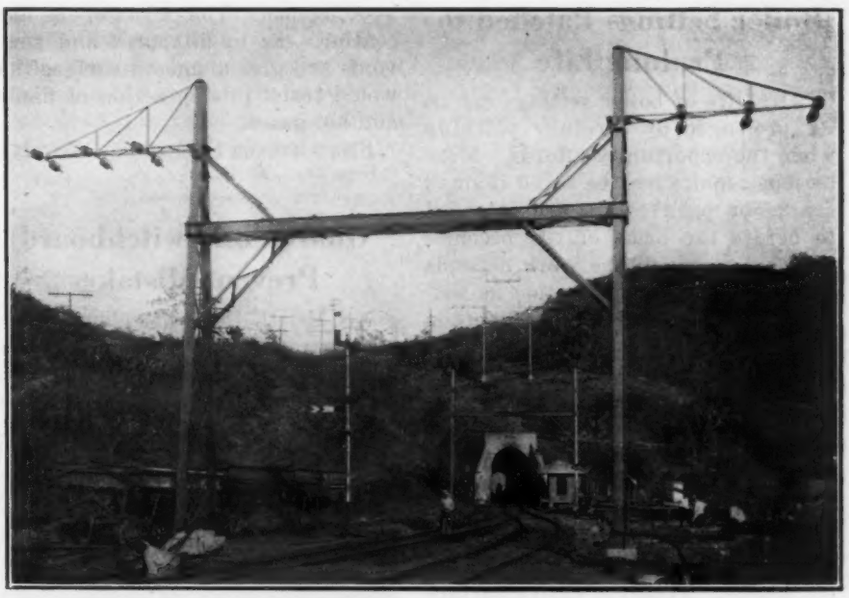
The Panama Canal transmission line on which the dynamite-sprung anchorage was used is shown in the two accompanying illustrations. The transmission line and its anchorage were described rather completely in the *Canal Record* of July 9, 1913. About 800 towers were erected, and



RESISTANCE TO OVERTURNING INCREASED BY THIS CONSTRUCTION

the anchorages aggregated more than 3,200.

The transmission-line tower of the Panama Canal is essentially a track-span structure that provides for the support of a three-phase circuit on bracket arms at each side, with a ground wire at the apex of each side



DOUBLE TRACK SPANNED BY TRANSMISSION TOWER CONSTRUCTION

frame. Provision was made in the design for a possible future installation of compound-catenary trolley wires.

The foundation under each of the side frames consists of two concrete pedestals cast upon a slab with a 4-ft. x 11-ft. base, 1 ft. thick. The base slab, which is reinforced longitudinally with used steel rails, provides the necessary foundation area for the worst assumed condition of broken conductors, and the weight of the backfill on top of the slab provides to a certain extent for the overturning moment.

Additional resistance to overturning is secured in the dynamite-sprung anchorage, which for each slab consists of two 8-in. holes, bored with a well drill to a depth of about 18 ft. The bottoms of these holes were sprung in exactly the same manner that drilled holes were sprung on the canal excavation work, to provide sufficient space for large dynamite charges. Steel-reinforcing rods having ends bent over at the bottom were inserted down the drilled hole, reaching to the bottom of the cavity, which with the 8-in. hole was solidly filled with a rich concrete mixture, well tamped.

The concrete ball at the bottom of the anchorage, when called upon to function in resisting overturning of the tower, bears directly on virgin earth (or shattered rock if the hole is drilled in rock), instead of bearing on the backfill of the customary transmission-line footings.

W. R. MCCANN.
Stone & Webster, Inc.,
Boston, Mass.

Cost of Transformers

AN EASTERN central station company located about 200 miles from the factory which supplied the equipment tabulated the cost of its distribution transformers purchased during 1922, and from these data the accompanying table has been prepared showing the cost per kva. at the factory for the different sizes purchased. All were 60-cycle designs. The cost of some miscellaneous equipment is also included.

TABULAR ANALYSIS OF 1922 DISTRIBUTION TRANSFORMER PURCHASES

Rating, Kva.	Voltage Ratio	No.	Price — Total	Price — Per Kva.
0.5	2,200/122/244	3	$99.84	$66.50
1.5	2,200/122/244	22	735.36	22.20
3	2,200/122/244	27	1,291.68	15.90
5	2,200/122/244	24	1,547.52	12.90
7.5	2,200/122/244	9	758.16	11.20
10	2,200/122/244	14	1,434.16	10.25
15	2,200/122/244	39	5,313.36	9.10
5	2,200/608	3	193.44	12.90
10	2,200/608	6	614.64	10.20
15	2,200/608	12	1,634.88	9.10
25	.....	3	592.80	7.90
50	2,200/608	3	976.56	6.50
100	2,200/608	2	979.63	4.90
100	13,800/600/2,400	3	1,950.00	6.50
1.5	575/115/230	1	36.48	24.30
5	2,200/1608	6	656.64	21.90
7.5	2,200/608	3	277.02	12.30
10	2,300/608	2	224.58	11.22
10	2,300Y/608	3	482.22	16.07
15	2,200/122/244	3	448.02	9.95
25	2,200Y/608	3	891.00	11.90
25	2,200/608	2	433.20	8.66
50	2,200/122/244	3	1,070.46	7.12
100	2,200/608	3	1,610.82	5.70
				Eahc
Thermal temperature indicators, price of 110			930.02	8.46
Transil oil, drums bought, 42			630.00	15.00
Freight and teaming, including a few other units not listed completely			639.98	.....

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Boiler Settings Patched to Prolong Life

THE life of boiler settings can be prolonged by carefully patching when the opportunity affords. More serious repairs may be saved if small cracks or open joints are attended to before the brick or tile becomes loose. Success in the work depends on the method of application as well as the materials used. The method used in patching the boiler of a large company in the Middle West has given very good results.

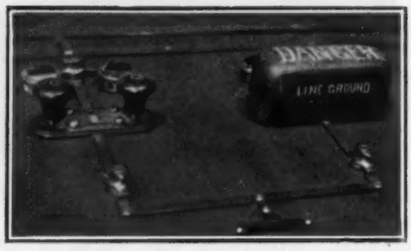
In this method the clinker was first removed and the surface chipped and nicked until most of the glaze was gone and the original texture of the brick exposed. Care was taken in this work so that the bricks would not loosen. Then the entire surface to be patched was brushed until free from dust. This surface was then well saturated with a thin milky wash of "hytempite," which was quickly absorbed by the exposed brick surface. The foundation for the patch, consisting of a somewhat thicker mixture, was then applied as a bonding coat. Where the surfaces were large this was done in sections so as to insure a moist surface for applying the patching mixture. The patching material consisted of diluted hytempite to which carbosand was added gradually until thoroughly mixed. The consistency was such that no free moisture showed when the mixture was squeezed in the hand. Care was taken to apply the patch while the foundation coat was still moist. The dark portions of the patching as seen in the background of the illustration show the method of applying the patch to a large surface by plastering on a small section at a time.

After the patching was completed on all large and small surfaces it was allowed to set for about an hour before applying a final surfacing of the same mixture as used for the bonding coat. The object of the final coating was to fill pores and small voids and give a smooth surface that would resist pitting action of flames and hot gases.

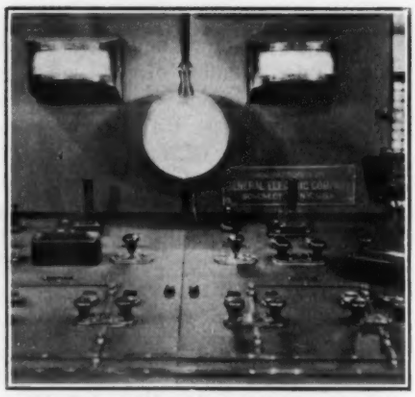
FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Guards on Switchboard Prevent Mistakes

ON MODERN power-plant switchboards it is necessary to take some precaution to prevent accidental or thoughtless closing of high-tension switches that have been opened for making repairs on equipment or for other reasons. This is generally done by tagging the switch in some manner, but the operators at Big Creek No. 1 power house of the Southern California Edison Company use the wooden block shown in the accompanying illustration for this purpose. Two holes are drilled in a wooden block, which is then chiseled out so it will fit over the oil-switch control knobs on the switchboard. On the top of the block is the word "Danger," on one side is "Line ground," meaning that the line is grounded at the station, and on the other side is "Men working." An operator would certainly have to be very careless or in a bad state of coma to remove this guard and close the oil switch without stopping to think whether everything was clear.



SIMPLE GUARD PREVENTS CARELESS CLOSING OF OIL SWITCH



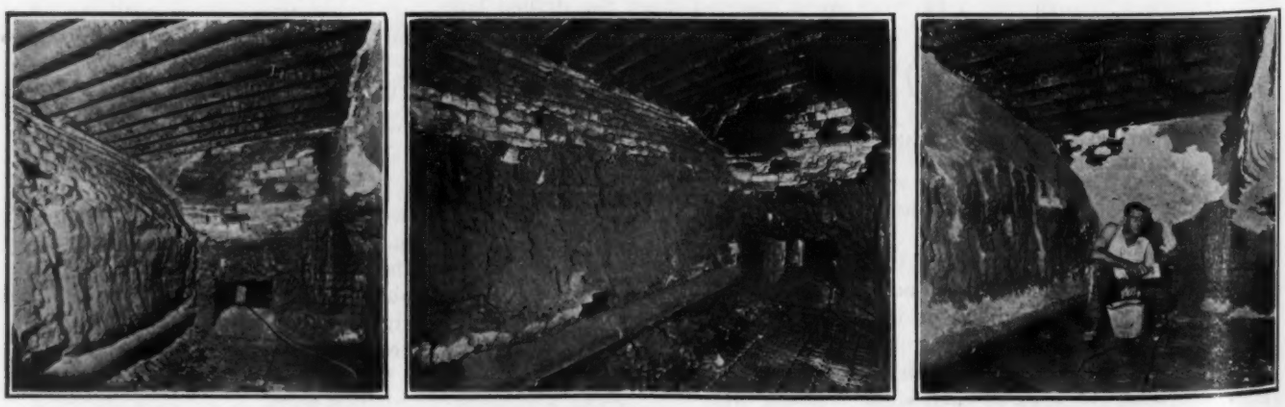
GENERATOR FIELD SWITCHES PROTECTED AGAINST ACCIDENTAL OPENING

Similar guards are used to protect the oil switch-control buttons on the generator field switches. The turbine governor-control switch is located right alongside the field switch-opening button. The governor switch requires frequent manipulation, and if an operator should carelessly pull the field-switch button instead of the governor-control button, the generator field switch would be opened and serious damage might result.

G. C. HECKMAN,
Superintendent Electrical Construction, Southern California Edison Company, Big Creek, Cal.

Venting of Transformers Direct to Air

IN the ELECTRICAL WORLD for March 31, page 753, there was an article regarding the experience of a Southern power company which operates its transformers with open air vents to encourage the circulation of air above the oil level, the idea being to sweep out the oil vapors. We have taken samples of oil from the transformers to which you refer and this oil has shown excellent color and dielectric characteristics. However, we believe that the company's success with this method of ventilation is due to the fact that its transformers are all operated at low temperature. It is



PATCHING MATERIAL APPLIED TO BOILER SETTING AVOIDS MORE SERIOUS REPAIRS

well known that the oxidation which occurs at temperatures usually encountered in power transformers is much reduced at abnormally low temperatures.

However, if the oil temperatures were as high as usual in power transformers, the sludging and deterioration of the oil would most certainly be accelerated by the circulation of air over the oil level. We should be interested to know by what theory the oil could possibly be kept in better condition through contact with air than by isolation from air.

W. M. DANN,
Transformer Engineering Department.
Westinghouse Electric & Manufacturing Company.
East Pittsburgh, Pa.

Extracts from an Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

How to Remove Scale from Evaporator Coils

"CRACKING down" of the evaporator effects is to remove the scale which is deposited on the coils. The rapid expansion of the metal of the coils, due to the sudden changes of temperature obtained, will crack the scale from the tubes. The specific instructions for cracking down evaporators as abstracted from the operating code of the Philadelphia Electric Company are given below:

CRACKING DOWN EVAPORATORS—FIRST EFFECT

1. Close the hand valve on the automatic feed-water valve control.
2. Close the steam valve to the coil and blow down the first-effect evaporator shell completely through the blow-down meter.
3. Close the blow-down valve.
4. Open the vent valve.
5. Fill the first-effect evaporator with cold filtered river water to the top of the gage glass.
6. Close the vent valve.
7. Close the vapor valve on the first effect.
8. Open the steam valve on the first-effect coil suddenly.
9. Close the steam valve when the cracking ceases and see that the pressure does not exceed 15 lb. or 20 lb. in the shell.
10. Blow down the shell to the discharge tunnel, completely.
11. Close the blow-down valve.
12. Open the hand valve on the automatic feed-water valve control.
13. See that the shell fills the hot water to the normal running level.

SECOND EFFECT

1. Close the hand valve on the automatic feed-water valve control.
2. Close the vapor valve on the second effect.
3. Open the vent on the low-pressure shell.
4. Blow down the shell completely through the blow-down meter.
5. Close the blown valve.
6. Fill the second-effect evaporator with cold filtered river water to the top of the gage glass.
7. Close the vent valve.
8. Admit steam suddenly to the second-effect coils through the steam line connected to the vapor line. Do not exceed 60 lb. pressure.
9. Close the steam valve when the cracking ceases and see that the pressure does not exceed 5 lb. on the shell.
10. Blow down the shell to the discharge tunnel, completely.
11. Close the blow-down valve.
12. Open the hand valve on the automatic feed-water valve control.
13. See that the shell fills with hot water to the normal running level.

FIRST AND SECOND EFFECTS

1. Open the vapor valves.
2. Proceed to put in operation according to rules for "Putting an Evaporator Into Service" given in the last issue of the ELECTRICAL WORLD.

Correcting Reversed Polarity on D. C. Generators

FOUR methods for correcting reversed polarity of direct-current generators are given in the operating code of the Philadelphia Electric Company. The first method is applicable only to compound-wound generators which can be paralleled with one or more compound-wound generators of correct polarity carrying load. The equalizer switches of these machines, when closed, connect the inner terminals of the series field windings of two or more generators in parallel, equalizing the potential at these points and thereby causing proper division of the total load current among the series-field windings. When the equalizer switches of all the machines in operation are closed and when the equalizer switch and the bus switch on the same side of the reversed machine are also closed, the series field of the reversed machine is placed in parallel with those of the machines in operation and so takes its normal share of the total load current. The current in the series field of the reversed machine is in the same direction as the normal operating current and thus tends to build up a field of proper polarity; if strong enough to overcome the residual magnetism, it will reverse the polarity to normal.

If this method fails to reverse the polarity, the method about to be described should be used. This method applies to shunt-wound or compound-wound generators when the bus can be energized from a source of correct polarity. By this method, with the positive machine switch open and the positive shunt-field lead connected to the positive bus, current flows through the shunt field circuit, but not through the armature when the negative and circuit breaker and negative machine switch are closed. This develops a field of correct polarity in the field circuit, and when the machine is shut down the residual magnetism will be of correct polarity. Therefore, when the machine is again started up, it will build up with correct polarity.

When no source of correct polarity is available, a third method known as "flashing" may be used. In this case the shunt-field leads are reversed and the circuit through the shunt field is closed for an instant while in this reversed condition. This causes a wave of current to flow through the shunt-field circuit in the normal direction and of sufficient strength to reverse the existing residual magnetism. If the machine is then started up normally, the field will build up with correct polarity.

The fourth method is applicable to motor-generators which can be started from the direct-current end. This method is based on the fact that a shunt-wound or compound-wound generator of given polarity must be supplied with current of the same polarity in order to operate as a motor in the same direction. When current of normal polarity is supplied to such a machine, it reestablishes the normal polarity of the field and, consequently, that of the generator.

Radio Communication Being Developed in the West

THAT radio communication is rapidly being adopted by Western power companies as a means of maintaining communication with their distant power plants during times when wire lines are inoperative was a feature brought out at the recent meeting of the sub-committees of the Technical Section of the Pacific Coast Electrical Association.

The Great Western Power Company is now using a carrier radio-telephone system between its Caribou plant and its receiving substation in

Oakland, a distance of 156 miles. This system is used for all dispatching and has been in successful operation for several months. The Pacific Gas & Electric Company is installing a similar system between its Pit River No. 1 plant and Vaca substation for operation over 200 miles of 220-kv. transmission line.

The Southern California Edison Company is using continuous wave wireless telegraph as the only means of communication between its main field office at Big Creek and its five construction camps in the upper Sierras. A total of 300,000 words a month are handled between these stations. This company is also experimenting with carrier radio telephone with a view to utilizing it as a means of communication between its Big Creek plants and the dispatcher in Los Angeles, a distance of 240 miles over its two 220-kv. Big Creek transmission lines. Carrier radio telephone seems to be generally favored where it is possible to utilize a transmission line running in a direct route between the two stations it is desired to keep in communication with each other.

On account of the character of the transmission system of the San Joaquin Light & Power Corporation conditions are not favorable for carrier radio, and it is experimenting with straight radio telephone. While carrier radio is working successfully in many cases, it is felt that a number of improvements will have to be made before it can be absolutely relied upon under all operating conditions.

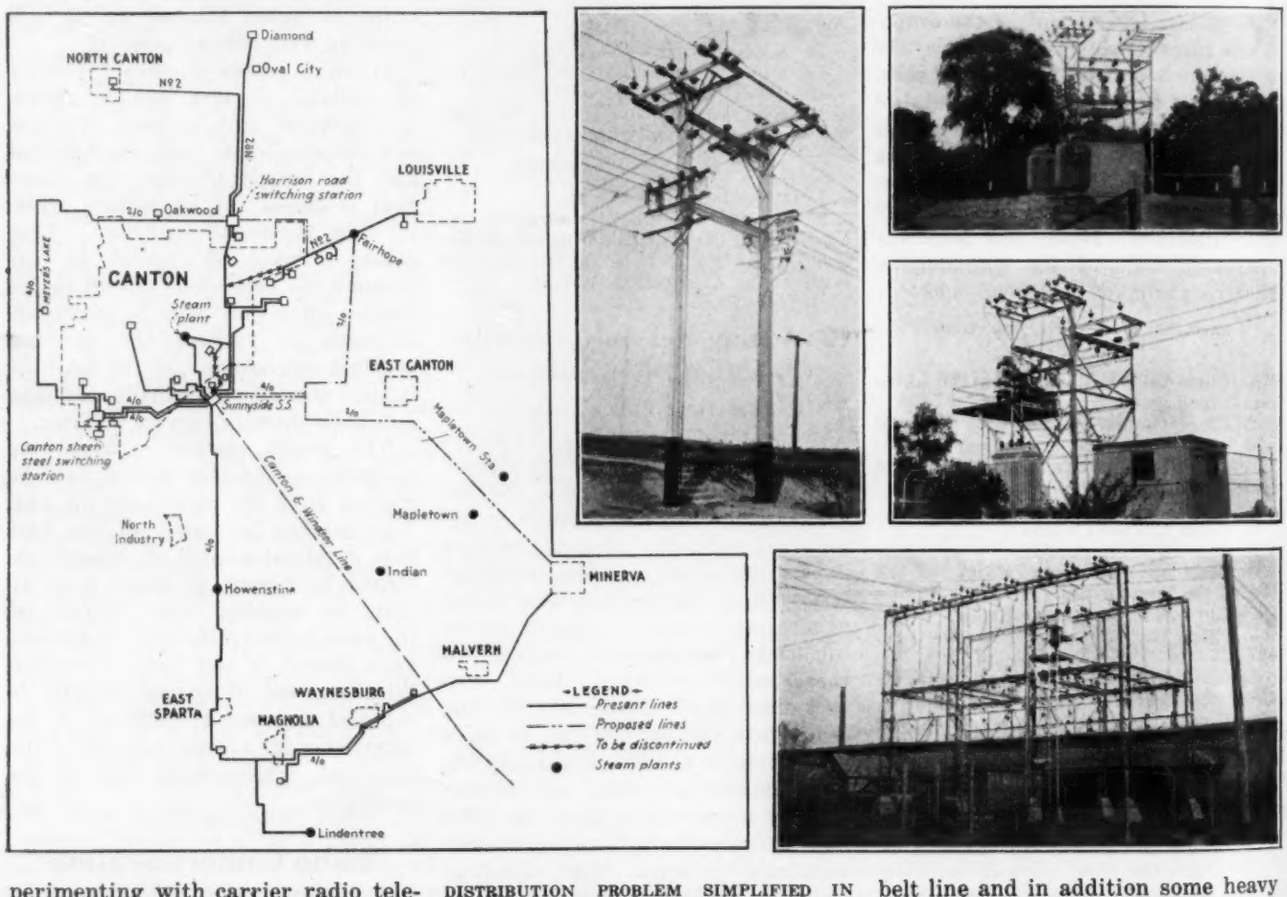
FIELD EDITOR ELECTRICAL WORLD.
San Francisco, Cal.

Belt-Line System Solves Distribution Problem

THE Ohio Power Company at Canton, Ohio, has had a very large increase in load during the past few years. This growth of business made its distribution problem complicated. The situation was met by building a 22,000-volt wooden-pole belt line around the city with transforming and switching stations at intervals. The line is complete with belt line and in addition some heavy industrial feeders.

At each switching station the incoming 22,000-volt lines go to a high-tension outdoor structure equipped with air-break switches, oxide-film arresters, etc., and thence to outdoor transformers. The secondary leads enter a concrete or brick switch house at 4,000 volts. In this switch house meters, relays, breakers and low-tension buses are installed. Underground construction is used from switch house to secondaries.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.



DISTRIBUTION PROBLEM SIMPLIFIED IN CANTON, OHIO, BY 22,000-VOLT TRANSMISSION BELT AROUND CITY

Left—General layout of transforming and switching stations. Upper right and right center—East Sparta and 750-kva. Oakland substations, typifying type of construction employed. Right bottom—Bryan Avenue switching station, terminus of 130-kv. line from Windsor. Top center—Oakland sectionalizing station.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Should Central Stations Merchandise?*

Considered from the Consumer's and Central Station's Viewpoint—Where a Utility Works with Dealers Experience Shows More Active Local Interest in Appliances

By A. W. Krueger
Edison Electric Appliance Company, Chicago

SHOULD the central-station company sell appliances? Our experience permits only one answer: "Yes—most emphatically." Everybody benefits through central-station appliance selling activity. The reasons for this are readily apparent.

Let us take the consumer. Not nearly the number of women today would know of and enjoy the benefits of electrical household devices had central stations remained inactive or indifferent to their educational responsibilities. Most of them would still be pushing a broom over their carpets instead of using a vacuum cleaner and realizing its tremendous labor saving. In most cases they would still be turning a flywheel on the family washing machine. They would not be enjoying the advantages of electrical cookery and many other similar benefits.

This one constructive factor in itself is sufficient reason for the central station to merchandise appliances, because by so helping their customers they render a real service as a public utility through bringing the public to a realization that electrical service only starts with lighting. Helping to educate the public, the central station benefits not merely through good will but very materially in dollars and cents because of increasing the energy day load, most of which is consumed at the lighting rate. In addition, nearly all central stations which sell appliances today are receiving from their commercial departments a merchandising profit.

The story of these benefits does not stop here. The widespread public acceptance of electrical appliances has automatically created thousands of electrical appliance dealers. They effectively supplement central-station activity. Their success means additional central-station day-load revenue. They are a valuable asset in broadening the appliance field and are well worth the closest cultivation and co-operation.

Merchandising Progress Gradual

In the early days of central-station merchandising thousands of flatirons were distributed at cost. In a great many cases they were actually given away. It was good business then because the increased day load more than offset the expense involved. The public began to realize the labor-saving advantages of electrical household devices. They began to appreciate that electrical service meant something beyond lighting bulbs. This, however, was not conducive to dealer expansion, for they could not compete. The practice was relatively short-lived because it was soon found that the public responded to intensive campaigning and people were ready and willing to pay reasonable prices for electrical conveniences. Central stations abandoned the earlier plan of no merchandising profit and put their individual commercial department on a profit-producing basis. They realized the advantage to themselves as well as to the dealer of the active co-operation of all electrical appliance-selling outlets, such as electric specialty shops, hardware stores, department stores and electrical contractors—in fact, every legitimate merchandising outlet for household devices. Manufacturers' suggested list prices were maintained, and an extremely healthy condition resulted—a condition that holds true today in virtually all communities.

It is unfortunate that there are today some dealers who still carry the point of view that the game is one-sided in favor of central stations. They have not stopped to analyze the facts of the case. A great deal of progress has been made in educating the dealer and making him a better merchant, but there is still room for a lot more good work that can be promoted by the central station to produce more harmonious relations between these branches of the industry.

George A. Hughes once declared: "Show me an inactive central station and I will show you a dead appliance town." This statement clearly defines the facts. Consider a concrete case, that of a busy Mid-Western city with a population of 250,000 inhabitants. Up to a few years ago the policy of the local utility was to sell energy and lamps only. "Leave it to the dealer," was its motto. Did the dealers appreciate this situation? Did they get busy and make the most of their opportunity? Did they advertise on billboards? Advertise in the newspapers? Conduct demonstrations? Circularize their mailing list? Did they ever make an appliance analysis of the town? Not so you could notice it! They sat back and wondered why their appliance business was not better.

Utility a Gage of Activity

The central station in question finally came to a realization of this condition. It decided to get busy and to become an active merchandiser and it believed in "doing the job up brown." A location was secured in the heart of the shopping district. No expense was spared in fitting out the display room as the outstanding appliance showplace of the city. Neither was any money spared in widely advertising that fact. A tremendous howl went up from the dealers. Appliance business was going to be ruined! The central station would wreck the whole merchandising works. It would kill what little had been accomplished.

What actually happened? The town just began to wake up to the value of appliances. Nobody had ever taken the trouble to tell it the

*An abstract of a paper presented before the Commercial Section, Indiana Electric Light Association, Indianapolis, May 3, 1923.

real story before. The central station used billboards, newspapers, sales letters, attractive windows and freely advertised the appliance shop. The public's interest was aroused. People were soon thoroughly "sold" on the electrical household idea. Appliance sales increased by leaps and bounds. Dealers who had bitterly fought the movement sold more appliances than they ever dreamed was possible. Department stores opened special electrical departments. Electrical specialty shops with high-grade equipment and merchandise sprang into being. Hardware stores got busy. Everybody was benefited. Even the dealers admitted that. Had the central-station company not changed from a passive to an aggressive merchandising policy, that city today would still be plodding along in the same old way.

There are a few exceptions, of course, where, for instance, the central station does not actually sell merchandise, but where it does actively co-operate with the dealers through showroom and window displays, billboards, newspaper advertising and special electrical shows. These cases, however, are exceptions to the general rule. Selling merchandise at cost has been proved unnecessary. Both merchandise and energy profit can be produced at the same time. Maintaining list prices puts everybody on an equal footing. The more everybody sells, the more the central station benefits; the more everybody sells.

Another concrete example of the result of central-station inactivity is the experience, some years back, of our company. Our selling records included a comprehensive map tack system. A black tack was placed on every town showing the location of our dealers, which in those days reflected the town's appliance activities in a large sense. The map was pretty well covered throughout the state with the exception of an area in central California that was practically barren of dealers. An investigation easily revealed the fundamental cause—central station passiveness and inactivity. The public was not "sold" on the electrical household idea. It was surprising to note how quickly this condition changed when these central stations interested themselves in appliance merchandising. The barren area filled up rapidly with tacks as new dealers sprang into existence.

Almost every central station maintains an office with a large amount of display room available. In the majority of cases they are active merchandisers. Great numbers of people come into their offices during the month to pay their bills. Aside from other considerations, this puts the central station in a very favorable position to merchandise which is not enjoyed by the majority of other classes of merchants. It is good business from every angle because the display room can be made to pay overhead and show a profit. How could we answer the question of "Should central stations sell appliances?" with anything but "Yes"? We believe that individual experience will justify this answer.

How Syracuse Connection Service Stood Up on Moving Day

THE account of the Syracuse (N. Y.) Lighting Company's method of connecting customers' service within three hours after the signing of the application which appeared in the ELECTRICAL WORLD of April 14 has aroused much interest among central-station men. One question has been raised as to how the system would operate under stress of abnormal conditions such as are presented by the annual moving of many customers from one house to another. Manager G. I. Vincent answers this question in describing the annual moving rush, which comes in Syracuse the last few days in April and the first two or three in May. He says:

"In a normal day about 150 orders go over the counter at our customers' department. About as many more go directly to the order executing department, as all trouble orders coming in on the telephone pass the customers' department altogether. In addition, the men pick up some orders themselves. On April 30 759 orders went over the counter. I watched the operations myself several times during the day and do not believe that any customer waited more than thirty seconds for attention. This flexibility is obtained by having a number of employees in adjacent departments trained to wait on the customer. These employees are engaged in work which does not have to be done instantly so they can drop it on call and return to it later. A buzzer at the customers' counter connects with this department, which is immediately adjacent. A touch of the button calls an employee at once. During one short period on April 30 there were sixteen employees at work on the counter.

"The number of orders of all descriptions executed in normal times is about 350 per day. On May 1 1,042 orders were completed and on May 2 2,322. As nearly as we can ascertain there was absolutely no customer left without service who desired it on either of these two days. Of course, very many had to request postponement from the first to the second of the month because they were unable to secure the services of the movers. The flexibility in the order executing department is obtained by using all alternates who are regularly engaged in other work and by dropping all routine work, such as changing meters.

"No attempt was made to keep actual time lapses because any of our customers securing service on these two days would be more than satisfied. On normal days we still maintain easily the bogey of two minutes for transmission and three hours for completion."

ONE OF THE SYRACUSE COMPANY'S EIGHTEEN SPECIAL TRUCKS USED IN ITS THREE-HOUR CONNECTION SERVICE

If 1923 Appliance Sales Were Increased 20 per Cent

CENTRAL-STATION companies recognize the importance of domestic appliances as load builders, but their full value becomes apparent only when it is considered that they may add over $75,000,000 to the annual gross income of these companies this year. This does not mean money received from the sale of merchandise—it is purely operating revenue from energy sales, and most of it at profitable rates. If the expectation, based on data compiled by *Electrical Merchandising*, is realized, $287,875,000 worth of appliances will be sold during 1923. These figures embrace in all 12,956,000 appliances classified as the accompanying table shows. And it is estimated that the income value of these appliances to be added to the lines in 1923, in revenue for energy consumed, will approximate $83,000,000. Consumption on the appliances included is calculated at a 10-cent rate and on the following annual income basis:

	Per Year
Washing machines	$3.00
Vacuum cleaners	4.00
Portable lamps	3.00
Flatirons	12.00
Fans	2.00
Ranges	60.00
Refrigerators	60.00
Radiators	18.00
Toasters	4.00

Naturally, these figures are only estimates, as no adequate definite information on this subject exists. Sewing machines, ironing machines, dishwashers, kitchen power units, violet rays, vibrators and utility motors have not been figured in because their consumption is still more difficult to estimate. Heating pads, curling irons, waffle irons, grills, hot plates, fireless cookers, hair driers and miscellaneous heating appliances, totaling in all 626,000 appliances, are lumped as good for probably $2,000,000 in revenue to the central stations.

Taken this way, as mass statistics, these totals carry little inspiration. It is interesting to consider, however, what any extra effort to increase the sales of these commodities would mean. On the above basis, if a 20 per cent increase were realized, this would mean a gain in sales to the central stations, dealers, contractors and other retailers of 2,591,200 additional appliances, bringing an additional income from sales of $57,575,000 and an increase in annual revenue to the central station of $16,303,000.

In an average city of 100,000 population it is estimated from these figures that electrical merchandise sales would be swelled by at least $100,000 and the local light and power company would secure an increase in residence appliance income of approximately $30,000. This calculation is based on the rough assumption that half the population of the United States is beyond the reach of power lines and would not be affected.

WHAT 20 PER CENT INCREASE IN APPLIANCE SALES WOULD MEAN

This tabulation is based on *Electrical Merchandising's* estimate of electrical appliance sales for the year 1923. It shows what a 20 per cent increase in sales would mean in terms of the various household appliances which, according to this estimate, will be sold this year.

Items	Est. No. Sold, 1923	Est. Retail Value	Energy Consumption per Unit per Year*	Estimated Annual Value of Energy Consumed by 1923 Sales	If 1923 Estimates Could Be Swelled 20 per Cent the Increase Would Be: Number of Machines Sold (Increase)	Value of Sales (Increase)	Annual Value of Energy Consumed (Increase)
Washing machines	600,000	$75,000,000	$3	$1,800,000	120,000	$15,000,000	$360,000
Vacuum cleaners	1,000,000	50,000,000	4	4,000,000	200,000	10,000,000	800,000
Portable lamps	3,000,000	30,000,000	3	9,000,000	600,000	6,000,000	1,800,000
Irons	4,000,000	24,000,000	12	48,000,000	800,000	4,800,000	9,600,000
Fans	800,000	16,000,000	2	1,600,000	160,000	3,200,000	320,000
Electric ranges	75,000	10,000,000	60	4,500,000	15,000	2,000,000	900,000
Electric refrigerators	22,000	7,000,000	60*	1,320,000	4,400	1,400,000	264,000
Radiators and heaters	400,000	3,800,000	18	7,200,000	80,000	760,000	1,440,000
Percolators and hollow ware	250,000	3,000,000	4	1,000,000	50,000	600,000	200,000
Violet rays	125,000	2,500,000	...	.....	25,000	500,000	.....
Toasters	500,000	2,400,000	4	2,000,000	100,000	480,000	400,000
Waffle irons, grills, hot plates, fireless cookers	165,000	3,175,000	3	.....	33,000	635,000	99,000
Heating pads	200,000	1,250,000	...	.....	40,000	250,000	.....
Curling irons	250,000	1,250,000	...	.....	50,000	250,000	.....
Hairdriers, miscellaneous heating appliances	200,000	2,000,000	3	2,000,000	40,000	400,000	120,000
Sewing machines	170,000	12,000,000	...	.....	34,000	2,400,000	.....
Ironing machines	63,000	7,500,000	...	.....	12,600	1,500,000	.....
Kitchen power units	100,000	5,000,000	...	.....	20,000	1,000,000	.....
Vibrators	300,000	3,000,000	...	.....	60,000	600,000	.....
Utility motors	225,000	3,000,000	...	.....	45,000	600,000	.....
Dishwashers	11,000	1,000,000	...	.....	2,200	200,000	.....
Miscellaneous motor appliances	500,000	25,000,000	...	500,000	100,000	5,000,000	.....
Totals	12,956,000	$287,875,000		$82,920,000	2,591,000	$57,575,000	$16,303,000

*Note.—Energy consumption figured at 10 cents per kilowatt-hour in case of all appliances except ranges and refrigerators, where 5-cent rate is assumed.

Purchased Power Gaining in Cement Industry

THAT the advantages of electric drive are well recognized by the portland-cement manufacturers is evident from the United States Census Bureau's recently published figures on that industry. The heavy power requirements of cement making and the development of conflicting tendencies with reference to the purchase of power from central stations give these figures especial significance. The trend toward the purchase of central-station power is verified by recent observations in the cement industry.

The total primary horsepower reported by cement manufacturers for the year 1919 was 488,808. With a liberal allowance for the comparatively small amount of natural and pozzuolanic cements made, over 485,000 hp. must have been devoted to the manufacture of portland cement. This includes purchased power, all of which was electrical. The average horsepower per plant was well over 4,000, while the total ranked the industry tenth among all manufactures.

Rented primary power increased nearly 23 per cent in the ten-year period 1909 to 1919, raising the percentage from 14.6 in the former year to 37.3 in the latter. Of the total power, 70.7 per cent was utilized to operate electric motors. Slightly over half of this electrical power—52.8 per cent, to be exact—was obtained from central stations.

Since the number of cement plants operating last year, the record year in the industry, was greater than in the slack period extending through 1919, and since the 1922 output was about 40 per cent larger, the power needed for cement making was also considerably more. The increase in installed horsepower was by no means proportional to the gain in production, however, for the plants were operating at only 60 per cent of capacity in 1919 and much of the manufacturing equipment was idle or running under light load. The

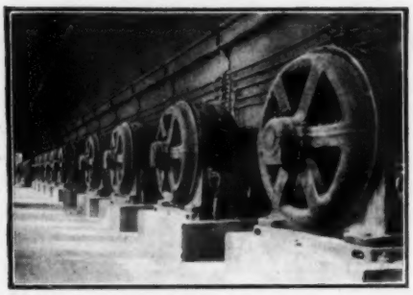
record output of last year was about 78 per cent of the producing capacity of the plants.

All recently built cement mills have been equipped for electric power, and several of the older establishments have changed over to the use of electricity since the last census was taken, in most cases buying power.

The consumption of power in the cement industry is chiefly in the many crushing and grinding operations. The raw materials, including the coal for the burning, must be finely pulverized and the resulting clinker reduced to a fine powder to produce cement. From the nature of these operations wear on cement-mill equipment is rapid. In consequence stoppages for repairs or replacements are frequent, making unit motors convenient and economical. Because of this suitability and the industry's heavy power requirements, it offers an important market for electrical energy—a market equal to that furnished by the manufacturers of glass, agricultural implements, paints and hardware combined.

The change to electric drive in some cases has brought unexpected complications. For instance, an electrically operated shovel was put to work in a cement-mill quarry alongside two steam shovels. The electric machine was repeatedly tied up by breaks in the shafts, while such mishaps were unknown on the steam shovels. Finally it was ascertained that whenever the electrical shovel took too big a bite the motor, instead of stalling, would momentarily carry 100 per cent overload, stressing the shaft to twice its designed capacity. As the load was suddenly applied, this proved enough to break the shaft, whereas with the steam equipment the engine merely stalled when the dipper was overloaded.

Since the shafts could not be made larger without a radical change in design, a special nickel-chrome steel shaft, carefully heat-treated, was employed. The new shafts then had twice the elastic limit of the metal used in the original shafts and were sufficiently ductile to withstand all usual shock and vibration, yet they were no larger.



BATTERY OF MOTORS OPERATING FINISHING MILLS IN CEMENT PLANT

Opposing the tendency to purchase power for cement-mill operation there is one factor to which cement manufacturers are giving careful consideration. That is the installation of waste-heat boilers for the utilization of the heat in the gases which leave the kiln at 1,200 deg. to 1,600 deg. F. in dry-process plants and 800 deg. to 1,100 deg. in wet plants. Though a number of these installations are in operation, their cost is high and involve large initial expenditures. Not only is the boiler equipment itself expensive, but the arrangement naturally entails a generating plant for which the cost of operation, maintenance, interest and depreciation may offset the apparent savings of the waste-heat boilers.

Customer's Monthly Bill and Check Combined

THE Bloomfield Utilities of Bloomfield, Ky., uses the reverse side of the customer's bill as a check should the customer at that time be without blank checks. Wherever possible the money is collected at the time of reading the meter. The meter readings are entered on this check, the bill figured and a 5 per cent discount allowed if the bill is then paid on the spot. By thus combining both the bill and a readily available check it is a very simple matter for the consumer to pay the bill on presentation, for all he has to do is to write the name of his bank, the amount of the check and his name.

What Other Companies Are Doing

Minneapolis, Minn.—As a result of an active employee-ownership policy the Northern States Power Company has increased the number of employee shareholders from 15 to 83.5 per cent. Out of the 2,180 employees, 1,820 now have one or more shares of the company's stock. This campaign was started a short time ago under the direction of R. F. Pack, vice-president and general manager, in order to induce the employees to share in the company's earnings.

Boston, Mass.—Fifteen thousand persons visited the electric home established by the Boston Electrical League April 14 to May 5, and sales of household conveniences and of house wiring appear to be directly traceable in many instances to this exhibit. A feature of the display was the visiting of the home by various groups of people residing in distant communities, automobile parties being made up for this purpose with provisions for their comfortable reception by members of the organization and their employees.

Illinois.—Following the example of the Commonwealth Edison Company, the Public Service Company of Northern Illinois has published a thirty-two-page year book, which presents to its stockholders detailed information relative to the business, properties and finances of the company in which they hold part ownership. The year book reviews the business of 1922, when the company served 220,160 customers, and points out the interesting fact that 36 per cent of the company's stock is now held by women.

Bloomfield, Ky.,_____ 192_

The _____ BANK

Pay to BLOOMFIELD UTILITIES $_____

_____ DOLLARS

Statement for month of _____ 192_

Name _____ Load_____

Meter Reading_____

Previous Reading_____

Kilowatt Hours_____ @ 20c Sliding Scale _____

Minimum monthly charge for electric service _____

Miscellaneous _____

If this bill is paid by the eighth of the month you may deduct 5 per cent of the charge for current amounting to ..... Total $_____

This bill has check printed on reverse side. It must be paid by the 20th of the month or we reserve the right to discontinue service without further notice.

If you pay by this check your bank returns your cancelled bill to you.

CHECK PREFERRED.

REVERSE SIDE OF BILL IS A BLANK CHECK FOR CUSTOMERS' CONVENIENCE

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Midway Plant of the San Joaquin Light & Power Corporation.—E. A. QUINN.—The presence of large quantities of natural gas developed as a byproduct from oil wells in its district had a definite bearing upon the locating of a steam-electric plant of the San Joaquin Light & Power Corporation at Buttonwillow, Cal. The low cost of the gas enables this company to supplement its hydro-electric power with the energy generated in this steam plant. Some of the features discussed are the boiler-room equipment and turbo-generators, which are rated at 10,000 kw., 11,500 volts, 80 per cent power factor, three-phase, 60 cycle.—*Journal of Electricity and Western Industry*, April 15, 1923.

Pulverized Fuel Plant at Providence.—The United Electric Railways of Providence is making power-plant improvements which will cost upward of a million dollars by installing new boilers equipped to burn pulverized coal in one-half of the present boiler house. An interesting feature of this installation is the method of ventilating the boiler walls. Drawings show the vertical section of the boiler plant and a plan view of boiler showing pulverized-coal equipment and cross-section of burner and mounting.—*Electric Railway Journal*, April 28, 1923.

Generation, Control, Switching and Protection

Short-Circuit Forces in Transformers.—J. BIERMANNS.—The electrical and the mechanical design of a transformer are frequently opposing problems, requiring a compromise solution satisfying fully neither of them. For example, from the standpoint of electrical strength it would be highly desirable to abstain from any solid material coil-supporting structure, because good oil is still the most dependable insulator. For mechanical reasons, however, the coils have to be strongly braced, to withstand safely the pressure of many tons exerted upon them during overloads or short circuits. The theory of short-circuit forces on transformers is not fully developed yet. Little can be found in textbooks, and nothing has been published as yet on the influence of asymmetries, such as must occur in the process of manufacture or the bringing out of leads and taps, upon the resulting unbalance of mechanical forces. In order to arrive at definite conclusions, the author was forced to idealize some of the conditions with which he deals, but this has been of such a nature as not to cause any appreciable difference between theory and practice. The developed formulas were checked on a 10,000-kva. transformer and gave values slightly higher than those actually measured. In his highly mathematical paper the author calculates the forces on a cylindrical transformer winding and modifies the equations for other types of coils, such as disk coils, etc. The short-circuit forces are first calculated for perfect symmetry between the windings themselves and between windings and the magnetic core and are then investigated for slight asymmetries. — *Bulletin de l'Association Suisse des Electriciens*, April, 1923.

Transmission, Substations and Distribution

Rotary Converters to Improve Power Factor.—E. EVERS. — A theoretical paper showing to what an extent the power factor of a network can be improved by using standard rotary converters. A six-phase converter is compared in its phase-regulating ability with other devices for the same purpose, and it is shown that a rotary can be used with economical advantage if the phase advance in the net does not exceed that equivalent to 80 per cent power factor, measured at the collector rings. For larger displacements the synchronous motor will be more advantageous owing to its lower cost.—*A. E. G. Mitteilungen*, March, 1923.

Unusual Sleet Formation on a 120,000-Volt Line.—C. DUVAL.—The double three-phase, 120-kv. transmission line of the Basse-Isère plant, connecting Beaumont with Saint-Etienne, passes over Mont Pilat (1,186 m. in height) and traverses a country of extremely rough climatic conditions. The cables used are steel-aluminum. In the most endangered sections the cross-section of this cable is increased from 102 sq. mm. to 148 sq. mm., while at the same time the normal span of 140 m. is reduced to only 80 m. Various forms of sleet formation on the line are described.—*Revue Générale de l'Electricité*, March 31, 1923.

Electricty on the Farm.—J. W. PURCELL and A. G. LANG.—A nine-page review of progress up to date in the Province of Ontaria as concerns electric light and power in the rural districts. The authors consider the difficulties encountered, the limited rural demand for power, basis for estimating rates, primary distribution, installation of power lines, pole spacing, underground construction and electrical appliances that may be utilized on farms.—*Electrical News*, April 15, 1923.

Units, Measurements and Instruments

Measurements of Oil Flow in Transformers. — F. MÜLLNER. — Two new methods are given for measuring the speed of the oil flow in transformers caused by the heating of windings. By the first method the time is determined which it takes for a thermometer to drop from a preheated point down to the temperature of the flowing oil. The faster the oil flows, the faster the mercury will drop. Calibration curves are given for these measurements, not only for oil, but also for water and air. The second is an electric method and is recommended for all cases where it would be impossible to read the indications of a thermometer. A very small ball of fine, insulated copper wire is wound, its diameter being only about ¼ in., its ohmic resistance at 15 deg. C. about 0.15 ohm. This measuring ball is used with three adjustable resistances in a Wheatstone bridge connection. The ball is inserted in the flowing oil, and the amount of watts is measured which is required to keep this ball heated to a constant temperature. This is accomplished indirectly by determining the resistance of the ball. The other three resistances of the bridge are varied in such a way as to keep the current through the bridge galvanometer zero. Calibration curves are given for different temperatures. — *Elektrotechnik und Maschinenbau*, April 8, 1923.

Production of Porcelain for Electrical Insulation.—F. H. RIDDLE.—This article deals with ceramic raw materials, chiefly clays, quartz and feldspar used in making insulators or insulating materials. Porcelains are now being used in which natural and synthetic sillimanite, reclaimed quartz and alkaline earth replace alkali.—*Journal of the A. I. E. E.*, May, 1923.

Illumination

Illuminating Business Districts.—S. B. WILLIAMS.—The author considers the reasons why an ornamental lighting system is an asset to the business district of every city, together with information gathered from numerous sources on desirable practice under present conditions for size of lamp, pole heights, spacing and arrangement, glassware, posts and illumination intensity, cost and the necessity for a maintenance schedule. Several types of painted posts and glass-globe units, suitable for white ways, are illustrated.—*Electrical Record*, April, 1923.

Flexibility in a Lighting System.—J. M. KETCH and A. F. IRISH.—The author shows the value of flexibility and how it can be obtained by adequate wiring and switching, correct spacing of outlets and selection of proper lighting reflectors. Among the factors that contribute toward flexibility of an electric system are the proper spacing of outlets, so that, regardless of the lamp wattage, a uniform level of illumination may be obtained over the entire work-

ing surface, an illumination of sufficient high foot-candle value to care for the most exacting work carried on, sufficient copper to permit more light or wattage to be obtained when needed, a switching arrangement that will economically provide light at the desired time and place, and the selection of a reflector that will allow for a future change in lamp size and wattage.—*Industrial Engineer*, May, 1923.

Motors and Control

Large Sump and Night Pumping Lower Peak Load in Coal Mine.—A. F. BROSKY.—By employing a large sump and pumping the water out of the mine during non-peak load, the Hecla Coal & Coke Company, at Isabella, Pa., has effected a very large saving. The water in this mine was originally pumped out by steam pumps, which have recently been replaced by electric pumps. Pumping at non-peak hours was made possible by employing a reservoir that holds over a million gallons into which the water gathers during the daytime. The electrical features of the installation for pumping are considered.—*Coal Age*, April 19, 1923.

Application of Electric Motors for Driving Tube Mills.—F. JEFFREY.—One method of individual drive is through the medium of a reduction-gear unit, the main gear of which is an integral part of the tube mill proper, and a low-speed direct-current motor. When dust and dirt are prevalent the gears may be inclosed and occasionally run in oil, although it is always advantageous to eliminate the foreign matter from the surrounding air if possible. Another method of individual drive is through the medium of the gear unit, but a high-speed motor is used and belted to a countershaft. Group drive is used extensively, and in cases of this kind the tube mills are usually belted to a line shaft. Such a method of drive presents a different problem, which may, however, be studied from a knowledge of the requirements of each individual mill and the results then combined in such a manner that all overlapping will be properly considered. The author discusses the application of the slip-ring-type induction motor and squirrel-cage motor to the tube mill, and the application of a synchronous motor to the tube mill.—*Journal of the A. I. E. E.*, April, 1923.

Heat Applications and Material Handling

Dimensioning of Contact Trolleys on Cranes.—E. ROSSECK.—The paper gives data on a great number of three-phase brake magnets and on a few brake motors, stating the current demand at the start and for holding the torque, etc. The motor brakes are electrically better and require much less current, but their high cost prevents their more general use. In a practical example, in which the current consumption of the lift motor of a crane is calculated and vectorially checked for each controller contact, the great importance of considering the large current demand by the brake magnets is illustrated.—*Elektrotechnische Zeitschrift*, March 29, 1923.

Heat-Insulating Materials for Electrically Heated Apparatus. — J. C. WOODSON.—While there are numerous grades of heat insulators on the market, there are none that can compete with electrical insulators. Of all the different grades, there are only a few fundamentally different sorts. In all of these materials the insulations are utilized almost entirely in the entrapped dead-air spaces of their structure. While the conductivity of an insulation is of primary importance, other thermal characteristics must be considered, such as specific heat and specific weight. The application also has to be considered with regard to the physical properties of the material.—*Paper presented before American Electrochemical Society, New York*, May 3-5, 1923.

Traction

Magnetically Controlled Track Switch —E. HALLE.—This apparatus, used to some extent on European street-railway systems, serves to set track switches from the running trolley car by means of an auxiliary contact on the trolley wire and a magnetic solenoid, actuating with a lever the tongue of the switch. Passing the contact with the current in the car on or off sets the switch in one or the other direction. A different trolley contact has to be installed for the arch-type or the wheel-type current collector. The apparatus may be erected above or entirely below the surface of the road and is in both cases built waterproof. To enable the motorman to see safely in which direction the switch is set during the night hours an automatically operated luminous arrow sign is usually part of the switch equipment. — *A. E. G. Mitteilungen*, March, 1923.

Locomotives for the Swedish Riksgräns Railway. — P. FRIEBEL. — The paper describes in great detail the freight and express locomotives being built for the Riksgräns railroad. This is a single-phase, 14,000-volt, 15-cycle main-road electrification, used primarily to haul heavy ore trains. The power transmission from motors to drivers is accomplished with an elastic pinion and gear to a jack shaft and with horizontal rods to two or four drivers. The freight engines are of the O-D-O type, whereas the express engines are built as 2-B-B-2 and represent two identical halves coupled together. It is of interest that the entire electrical equipment of one-half of the express-type locomotive is in every respect the same as that of the freight-type engine. Some of the characteristic data of these two machines are given in the accompanying table.—*Elektrotechnik und Maschinenbau*, April 22, 1923.

CHARACTERISTICS OF FREIGHT AND PASSENGER LOCOMOTIVES

	Freight	Express
Length over all, m	11.25	21.4
Diameter of drivers, mm	1,350	1,350
Weight complete, metric tons	68.6	123.2
Weight of electric part, metric tons	42.1	70.6
Weight of mechanical part, metric tons	26.5	52.6
Maximum speed, km.-hr	60	100
Maximum torque at start on circumference of drivers, kg	18,000	16,000
One hour output of locomotives, hp.	1,130	2,260
Number of motors	2	4
Motor current for one hour rating, amp	1,700	1,700

Telegraphy, Telephony, Radio and Signals

Use of Loud Speakers in a Hospital. —A unique use of telephonic loud speakers has been made in a French hospital where medical students can watch operations performed by a surgeon. Above the operating room is a glass roof through which the procedure of the operation can be observed. The surgeon, who gives during his work an explanation of what he is doing, talks into a microphone, the current of which is amplified by a battery of ten electron tubes, and actuates a number of loud-speaking telephones in the upper observation room so that the students not only see what the surgeon is doing but receive also the necessary explanations at the same time.—*Radio Electricité*, April, 1923.

Theory of Electric Wave Filters Built Up of Coupled Circuit Elements. —L. P. PETERS.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. mid-winter convention, Feb. 24, 1923, on page 442.—*Journal of the A. I. E. E.*, May, 1923.

Some Improvements in the Poulsen Arc.—P. O. PEDERSON.—The possibility of increasing the efficiency of the Poulsen arc by burning it in a non-homogenous magnetic field is mathematically investigated and experimentally verified.—*Proceedings of the Institute of Radio Engineers*, April, 1923.

Development of Cables Used in the Bell System. — F. L. RHODES. — The author discusses early types of cables, loaded cables, the application of repeaters to loaded circuits in cable, quadded cables and various types of sheathing for cables. — *Bell Telephone Quarterly*, April, 1923.

Miscellaneous

Methods of Analyzing Power Costs.—A. J. WHITCOMB.—An analysis of the different ways in which power costs can be checked and distributed among departments or processes in proportion to the amounts required. The author deals with the auditing of power-service requirements and tells what a proper distribution of power costs is and what it is not. He points out that power in kilowatt-hours represents dollars and cents of the same kind that go into the pay envelopes for labor. For the same reason that the paymaster is not allowed to make an error of 10 or 15 per cent in figuring his payroll, the method of accounting for power used should not permit such a range of guesswork. —*Industrial Engineer*, April, 1923.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Discuss Power Test Codes

Public Hearing at Montreal Convention of A. S. M. E. Arouses Interest—To Work with N. E. L. A.

MEETING in Montreal for its annual spring convention on Monday to Thursday of this week, with a registration of more than six hundred, the American Society of Mechanical Engineers held a public hearing on two of the nineteen power test codes being framed for suggested international adoption. These two codes deal with standardized measurements for power equipment and for internal-combustion engines. The hearing created great interest and much discussion. The general opinion was that it would be desirable to co-operate with the National Electric Light Association's code committee on the same requirements.

H. G. Acres, hydraulic engineer of the Hydro-Electric Power Commission of Ontario, predicted the use of propeller-type turbines for the St. Lawrence development and stated that the Johnson valve and surge tank, the spreading draft tube and the Kingsbury bearing had made possible large turbine development. Recent tests showed that the turbine in which the hydrocone extended to the runner hub was the most efficient type. The Queenston unit gave 93 per cent efficiency by the Gibson method, he said. Prof. R. W. Angus said that Mr. Acres' paper applied also to low-head plants. H. B. Taylor and L. F. Moody agreed with the statements made in the paper. Mr. Taylor said there was no limit to the size of units from the construction standpoint.

A paper on steam-line sectionalization and control presented by Peter Payne Dean, president Payne Dean, Ltd., Stamford, Conn., was well received.

Power Survey Bill Becomes Law in Pennsylvania

Governor Pinchot of Pennsylvania has signed the power survey bill passed by the Legislature at his instance. This law creates a board, consisting of the Governor, Attorney-General, Commissioner of Forestry, secretary of the Water Supply Commission, chairman of the Public Service Commission, Secretary of Agriculture, Commissioner of Labor and Industry, State Geologist and a Deputy Attorney General, to undertake an outline survey of the water and fuel resources available for the state and of the most practicable means for their full utilization for power development. The board is also empowered to recommend in outline a policy with respect to the generation and distribution of electrical energy to railroads, farms and homes.

The Governor has also signed the bill providing for a board to confer with similar agencies of New York and New Jersey on the regulation of the flow of the Delaware River

Los Angeles' Public Service Body Wants $35,000,000

A thirty-five-million-dollar bond issue to cover the projected activities of the Public Service Commission of the city of Los Angeles will be voted on at the municipal election June 6. Approximately $10,000,000 will be spent in rehabilitating the city distribution system and in improvements to the present hydro-electric system, if the voters indorse the issue. The remaining $25,000,000 is to be used for power development at Boulder Canyon on the Colorado River when the dam at that location is completed. The bond issue is being opposed by the Taxpayers' Association, a newly formed organization.

Los Angeles Loses Again

Highest Court Decides Against Its Power to Acquire Property Already in Use to Serve Public

THE United States Supreme Court has recently dismissed the petition of the city of Los Angeles for a rehearing of the city's case against the Southern Sierras Power Company for condemnation of property owned by the power company on the Owens River, in southern California. The decision of the Supreme Court ends a controversy which has been in progress since February, 1920. The first decision, handed down by the United States District Court, granted the city a right to condemn the property. The power company appealed to the United States Circuit Court, and Nov. 5, 1922, that body decided that no showing had been made that the public use of natural resources by a municipal corporation was more necessary than use by a public utility privately owned and serving other communities. The decision of the lower court was thus reversed.

Throughout the litigation the cities of Riverside and San Bernardino gave legal assistance in the fight against the city of Los Angeles.

A bill designed to give Los Angeles the power sought and now finally denied her was recently tabled in the State Senate.

Contracts for 240,000 Kva.

Generating Equipment Ordered from Canadian Westinghouse by Quebec Development Company

EIGHT hydro-electric generators rated at 30,000 kva. each at 80 per cent power factor, generating 13,200 volts, three-phase, 60-cycle, at 112½ r.p.m., have been ordered from the Canadian Westinghouse Company, Hamilton, Ontario, by the Quebec Development Company. These generators are to be of the vertical-shaft type equipped with Kingsbury thrust bearings. A directly connected exciter with a capacity of 225 kw. at 250 volts will be supplied with each generator. The contract also includes the installation of this equipment in the new plant of the Quebec Development Company at Isle Maligne, on the Saguenay River, 3 miles from Lake St. John. The apparatus covered by this order was designed by the engineers of the Canadian Westinghouse Company in collaboration with the engineers of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., and is of standard Westinghouse construction. It will all be built in the Hamilton shops of the Canadian Westinghouse Company.

In December, 1922, James B. Duke, president of the Southern Power Company, and Sir William Price, president of Price Brothers & Company, Ltd., of Quebec, incorporated the Quebec Development Company for carrying out the great hydro-electric and paper-mill project described in these columns at that time. A potential development of 1,200,000 hp. through the construction of a dam at the Grand Discharge from Lake St. John at the head of the Saguenay River is foreseen.

Price Brothers will erect two new mills in which much of the new power will be used, and existing mills will be converted to the use of electric power. They have agreed to take from the company 200,000 hp., perhaps the largest contract ever placed by a consumer for electric power. It is estimated that the saving of coal thus effected will amount to $1,500,000 yearly. The cost to Price Brothers of building the new mills and making alterations to the old ones is put at about $17,000,000.

Of the eight officers and directors of the Quebec Development Company, six are American and two are Canadian. The company, which is incorporated under Canadian law, is capitalized at $25,000,000, the entire capital stock being supplied by Mr. Duke and Sir William Price.

Federal Board Activities

Declarations Filed Affecting Development of Delaware and Future Status of Muscle Shoals

A DECLARATION of intention has been filed with the Federal Power Commission by the Pennsylvania Power & Light Company, a subsidiary of the Electric Bond & Share Company, covering a large project in the vicinity of Scranton, where it is proposed to construct a reservoir storing 9,000,000,000 cu.ft. of water. It is proposed to develop 47,000 kw. in the Wallenpaupack River. This reservoir will have an important bearing on the development of the Delaware River. Plans being considered for the development of this river call for the ultimate harnessing of 450,000 hp. between Hancock, N. Y., and Belvidere, N. J.

Another declaration of intention has been filed with the commission covering a project on the Pigeon River in North Carolina. The Pigeon River is a tributary of the French Broad River, which in turn is a tributary of the Tennessee. While the Pigeon River project concerns a development of only 30,000 hp., it is regarded as possessing great significance. This proposal, together with projects on the Clinch, Powell and Holston Rivers, indicates that big interests in the power and industrial fields have turned attention to this important region. It is understood that most of the power is being sought for electrochemical and electrometallurgical use. It is fully expected that the next few years will see the power resources of this region developed as they have been on the eastern slope of these mountains by the Southern Power Company. These developments, however, are being actively opposed by certain interests concerned with the development of Muscle Shoals as it is feared they may detract from carrying through cherished hopes.

As much as possible of its pending business will be disposed of by the commission prior to June 15. On that date two of its members, Secretary Work and Secretary Wallace, will leave with the President on his Alaska visit. This will preclude any further meetings of the commission until early fall, and for that reason a large amount of important business will be transacted in the next two weeks.

Electric Steel Founders Pursue Research

The "electric steel founders' research group" held a regular meeting of executives of the five electric steel foundries conducting co-operative research work at Wernersville, Pa., on May 14 to May 17. Representatives were present from the Electric Steel Company of Chicago, Fort Pitt Steel Casting Company of McKeesport, Pa.; the Lebanon Steel Foundry of Lebanon, Pa.; the Michigan Steel Casting Company of Detroit and the Sivyer Steel Casting Company of Milwaukee, in addition to R. A. Bull, research director of the group.

The various phases of the research work being done by the members of the group to improve the quality of steel castings and increase efficiency in methods were discussed in detail. Formal reports giving the status of the present research investigations were read on such subjects as facing-sand mixtures, core-sand mixtures, electric furnace practice, heat treatment of steel castings, production control, porosity in castings, etc. Plans were made for conducting research investigations on additional steel foundry problems. The results obtained from the work done have, in the opinion of the research group, been so beneficial as to make it highly desirable to study intensively some of the additional complex problems involved in making thin-section electric steel castings of intricate design.

Missouri Operators Sail the Mississippi

Transmission Economics, Oil Engines for Small Central Stations and a Manufacturer's Viewpoint of Utility Problems Are Discussed at Annual Convention Afloat

ELECTRICAL transmission problems dominated the proceedings of the seventeenth annual convention of the Missouri Association of Public Utilities, which was held aboard the steamer Harry G. Drees on May 23-26. The paper on this subject had been prepared by L. W. Helmreich and N. C. Mann, engineers of the Missouri Public Service Commission. Besides explaining the economics and value of interconnection, four factors were considered in analyzing the future growth of long transmission lines, namely, absorption of acquired isolated plants, formulation of equitable rate structures for transmission groups, financing of initially unremunerative projects, especially rural service, and, lastly, conflicts with communication systems.

With regard to the financing of rural lines, Mr. Helmreich reviewed the practices adopted by other states and concluded that while transmission and primary rural extension lines may be viewed simply as extended urban primaries, the main rural lines represented an investment serving a restricted, unchanging group.

F. S. Dewey, Kansas City, warned operators of a future day when rural reconstruction will be a still harder problem for the utility and the farmer if the utility does not require a high grade of construction at the present time. J. E. Hillemeyer, St. Louis, urged that more study be given to the uses of power on the farm in order to reduce the fixed charges and energy rates. He failed to see why a telephone company operating a grounded system should be allowed to blame unbalance on the power companies. W. F. Corl, Mexico, declared that since electricity would eventually decentralize industry by bringing it out to the country it was better to give the farmer service than eventually to face a farmers' "bloc."

PLAN FOR RURAL RATES

N. C. Mann presented an illustrated paper on proposed rates which would be proportional to the product of the connected load and its distance from the generating plant. The plan was to isolate and deduct from the total system charges those peculiar to transmission elements. The remainder would form a basic rate structure applicable throughout the entire group. The deductions properly allotted would determine the differential to be added in each case to the basic structure.

On Thursday morning George A. Hughes, president Edison Electric Appliance Company, Chicago, treated public utility problems from a manufacturer's viewpoint with special reference to social and economic unrest. He pleaded for an avoidance of prejudice as well as of socialistic pitfalls.

W. H. Henby reported on the year's work of the Missouri Committee on Public Utility Information, which is now distributing 1,900 copies of its weekly bulletins to 600 state newspapers, high schools and members of the Legislature. He felt that if utilities based their story on the development and conservation of national resources, they would encounter little difficulty when asking for higher rates.

J. D. Van Maur, St. Louis, thought that the public was fair-minded when once it was told all the facts in terms it could understand. He drew especial attention to the published letters from high-school principals commending the committee for its work with the classes in economics and science.

DIESEL-ENGINE COSTS

The paper on the application of oil engines for small central stations prepared by Stanley Stokes, St. Louis, was read in his absence by J. E. Hillemeyer. Cost data were included from five plants ranging from a capacity of 50 kw. to 1,000 kw., with a net monthly generating cost per kilowatt-hour varying from $0.0369 to $0.1833. Since it was the load factor which created such a wide variation in costs, the investment costs must be kept at a minimum. Costs on the Diesel type will run $168 to $187 per kilowatt of rated capacity fully installed.

J. B. Sheridan, manager of the Public Utility Information Bureau, gave a comparison of utility earnings for 1915 and 1921 during a period when the total operating expenses of Missouri electrical utilities had increased 136.3 per cent with a decrease in net return of 33.9 per cent. For the same period taxation had increased 170 per cent, coal costs had jumped 170 per cent and labor 131 per cent.

A question-box session was conducted Saturday morning. J. E. Hillemeyer, St. Louis, advised a continual checking up of suspicious bills and favored informing the public of the new state law which holds that a discovered "jumper" is prima facie evidence of theft of electrical energy. Some apprehension as to lawsuits for damages in case of failure to secure conviction was expressed, but John C. Hall St. Louis, urged that utilities should not hesitate to apply the law.

PRESENT VALUATION

The reproduction-new basis of valuation was questioned by C. C. Hellmers of Maryville, James R. Abercrombie of St. Joseph and F. S. Dewey of Kansas City, since it would require continual revaluations without consideration of high costs of construction during a boom period. W. F. Corl and Ben H. Locke, Mexico, felt that since prices of other commodities varied with exchange values utility rates should be based on the same principle.

F. S. Dewey said that since a utility's turnover usually is only once every five years instead of four to five times yearly, it would not need much argument to make the business man see the absolute necessity of an 8 per cent return.

For the coming year the following officers were elected: President, H. C. Blackwell of Kansas City; vice-presidents, J. D. Von Maur of St. Louis, C. L. Proctor of Joplin and Wiley F. Corl of Mexico; secretary and treasurer, F. D. Beardslee. The members of the executive committee will be L. P. Andrews, chairman; E. R. Locke, Herman Spoehrer, F. S. Dewey and John P. Casey. The attendance on this trip numbered 150.

Westinghouse Jobbers in Session

The eleventh annual convention of the Westinghouse Agent-Jobbers' Association has been in session this week at Hot Springs, Va. The only open meeting was held on Monday afternoon. E. W. Lloyd, chairman of the Joint Committee for Business Development, opened the program and described the work of that organization and its plans. The need for a wider appreciation on the part of the dealer of the fact that his prime function is that of purchasing agent for the public was discussed at length by Howard Ehrlich, editor of the *Jobbers' Salesman*. He pointed out that too many dealers maintain the point of view that they are merely representatives of the manufacturers, whereas the public looks to them for actual advice and assistance in the acquiring of electrical equipment for their homes.

An interesting analysis of the present set-up in retail distribution of electrical merchandise and appliances was presented by H. A. Lewis, manager of *Electrical Merchandising*, in which he pictured the present position of the department store, the hardware store and the drug store in the electrical market. There are at the present time, he said, four thousand department stores and ten thousand hardware stores selling electrical appliances. The department store has a distinct feminine appeal and is chiefly interested in selling staples. The hardware store appeals particularly to men and is organized and habituated to selling established specialties, among which it has gathered a considerable number of electrical devices. About one thousand drug stores are selling electrical merchandise also, principally through window and counter display, and with practically no creative selling. Because the electrical manufacturer in the effort to protect the electrical trade is not selling these retailers quality merchandise, they are largely stocking cheap goods and the public is receiving an improper impression of the quality of electrical merchandise. Mr. Lewis recommended that the electrical industry meet this situation by selling the non-electrical retailer quality merchandise so that the public may select electrical appliances intelligently and not with only cheap goods before them.

Frank E. Watt, editor of the *Electrical Record*, discussed "Liquid Capital as a Check on Business Depression." William L. Goodwin presented the present program of the Society for Electrical Development. An extensive program of committee reports and discussions was scheduled to fill the rest of the week.

Jobbers Launch Simplification Program

Many Recommendations Made for Elimination of Excess Varieties—Committee Appointed to Work with Manufacturers and Department of Commerce

DECIDED impetus was given to the promotion of a practical program for simplification in the electrical industry at the last day's meeting of the Electrical Supply Jobbers' Association at its annual summer convention at Hot Springs, Va., last week. Definite recommendations were made by a number of the commodity committees for the elimination of excess varieties in several important lines. The general principle of simplification was enthusiastically indorsed, and a committee was appointed to get in contact with the manufacturers and endeavor to influence a larger reduction in stock varieties and also to call upon Secretary Hoover of the United States Department of Commerce and enlist the aid of the Bureau of Simplified Practice.

COMMITTEE RECOMMENDATIONS

The committee on wire conductors recommended that the number of varieties of heater cord be reduced to one or two and that silk cord be reduced from the twenty-four colors and styles now listed to five or six. The committee on pole-line hardware reported many excess varieties, notably in cross-arm braces, and recommended to the manufacturers a careful study of the existing duplications and the elimination of as many styles as possible. The committee on wiring devices reported that the General Electric Company has recently dropped 860 numbers from its line, Bryant Electric Company 500, Harvey Hubbell, Inc., 400, and Hart & Hegeman 157. The committee held a meeting earlier in the week with representatives of the wiring-device manufacturers, who were present at the convention, and discussed the progress that has thus far been made and the possibilities for further action. An urgent request was made that other manufacturers take similar action in regard to their lines and that these removals be eliminated from all new catalogs both of the manufacturers and the jobbers.

The committee on heating devices called upon the manufacturers to reduce the number of varieties of household appliances, particularly hollow ware, and a questionnaire is being prepared for the purpose of determining what devices should be dropped. Special emphasis was given to the need for standardization of contact pins and plugs at the appliance end of the cord, and manufacturers were asked to adopt the practice of dropping one of the older models whenever a new style is brought out. A resolution was offered by this committee and passed by the meeting addressed to the National Electric Light Association commending the work of the N. E. L. A. wiring committee. The committee on fans recommended the complete elimination of the 16-in. non-oscillating fan, now already abandoned by several manufacturers, and reported that the cost of the ceiling fan is at present entirely out of proportion to the cost of desk-style fans and is seriously interfering with its sale, urging the manufacturers to readjust fan prices on a more equitable basis. The outlet box manufacturers were reported to have already reduced the number of styles from 116 to 21, and it was stated that they are ready to go to one finish as soon as the conduit manufacturers will standardize on one finish for conduit. In support of this situation conduit manufacturers were urged to give consideration to the possibility of the elimination of black iron conduit and the adoption of the galvanized finish as a single standard.

GOING TO HOOVER

Universal enthusiasm marked the delivery of an address by W. A. Durgin, chief of the Division of Simplified Practice, United States Department of Commerce, in which he pictured the progress that has been made in various indus-

tries in the elimination of obsolete, duplicate and other excess varieties. A resolution was passed requesting the Associated Manufacturers of Electrical Supplies to invite Mr. Durgin to give his address at the coming convention of this group of manufacturers in New London on June 26, and a committee on standardization and simplification was appointed, consisting of E. C. Graham (chairman), W. I. Bickford, F. W. Van Winkle, Frank S. Price, Clarence Wheeler, George Cullinan and George W. Johnston. This committee was instructed to confer with the standardization committee of the manufacturers' association in an effort to promote cooperation in the development of the purposes of simplification within the electrical industry and to proceed to Washington for a conference with Secretary Hoover.

Alabama Company Ready to Develop Tallapoosa

The Alabama Power Company hopes to begin preliminary work on the first of its Tallapoosa River projects by June 15. It will be necessary to build 25 miles of railroad so as to connect the site with transportation. Ultimately the company expects to develop six sites on the Tallapoosa. Plans for this project have just been completed by O. G. Thurlow, the chief engineer of the Alabama Power Company, and provide for the initial installation of two 50,000-kva. units and the ultimate installation of another similar unit.

Application has been made to the Federal Power Commission for the license covering the first development. It is the lowest location on the river and is known as the Cherokee Bluffs project. A dam 105 ft. high is to be built at that point, which is 12 miles above Tallassee, Ala. This dam will create a reservoir with a superficial area of 22,000 acres. The company will be required to discharge a certain maximum flow so as to meet the requirements of navigation in the Alabama River below Montgomery. This requirement is being drafted in such a way that the discharge in the Coosa and the Tallapoosa may be co-ordinated in the satisfying of navigation requirements. Very little storage is possible on the Coosa, so that in high water the Tallapoosa can be stored and the load carried on the company's Coosa plants, while in low water the load will be put on the Tallapoosa plants.

Training for Leadership to Be Keynote of S. P. E. E.

For its thirty-first annual meeting at Cornell University, Ithaca, N. Y., on June 20-23, the Society for the Promotion of Engineering Education has adopted as its general theme "Training for Leadership." An address with this title will be made by Dexter S. Kimball, dean of the College of Engineering, Cornell. Other prominent educators who will speak or take part in discussions on this and closely related subjects are C. F. Scott, J. H. Dunlap, M. E. Cooley, F. W. McNair, D. C. Jackson, H. E. Dyche, F. E. Turneaure, G. B. Pegram, F. L. Bishop, G. O. Frampton and Ira N. Hollis. "The Engineer as a Leader in Public Service" will be discussed by T. H. MacDonald, chief of the Bureau of Public Roads, Washington, D. C.; "The Engineer as a Leader in Industry" by Oliver S. Lyford, representing the National Industrial Conference Board, and "The Engineer as a Leader in Business" by W. E. Wickenden of the American Telephone & Telegraph Company.

Others who will take prominent part in the proceedings are Profs. J. Raleigh Nelson of Michigan, Edward Bennett of Wisconsin and L. S. Marks of Harvard and Chancellor J. A. Bowman of Pittsburgh. On Wednesday evening, June 20, President Livingston Farrand of Cornell will make his welcoming address, responded to by Professor Scott, president of the society; on Thursday evening the annual dinner will be held, and on Friday evening a "round-table" smoker.

May Yield Advances to 6.47 per Cent

A TOTAL of $52,026,000 in new electric light and power public utility financing was placed on the market during the month of May. This figure represents a decrease of more than $13,000,000 under April and of more than $17,000,000 under May, 1922. The offerings were large in number—twenty-one—but small in volume. Only two issues exceeded the five-million-dollar mark. The largest single issue was the ten-million-dollar issue of the Illinois Power & Light Company, offered at par and yielding 7 per cent. The average rate of return yielded the investor advanced considerably, from 6.38 per cent in April to 6.47 per cent in May, and was the highest since December, 1922. While the tendency toward long-term securities is still evident, three short-term issues appear in the accompanying tabulation.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN MAY

Name of Company	Amount of Issue	Period, Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Arkansas Central Power Co.	$2,500,000	25	First and refunding mortgage gold bonds	To provide working capital	6	94½	6.45
Paducah Electric Co. (Ky.)	1,006,000	15	First mortgage sinking-fund gold bonds, series A	Refunding	6	97½	6.25
Counties Gas & Electric Co. (Pa.)	6,600,000	30	First and refunding mortgage gold bonds	Additions and refunding	6	98	6.15
Illinois Power & Light Corp.	10,000,000	30	Sinking-fund debenture gold bonds, (closed issue)	Refunding and to provide working capital	7	100	7
Salt River Valley Water Users' Assn. (Ariz.)	1,800,000	5–24*	Gold bonds	Extensions	6	99	6.10
Tennessee Electric Power Co.	2,500,000	24	First and refunding mortgage gold bonds, series A	Additions, extensions and refunding	6	94½	6.45
Arkansas Light & Power Co.	500,000	....	Cumulative preferred stock	Extensions	7	92½	....
Penn Public Service Corp.	2,500,000	15	Convertible gold debentures	To acquire common stock of Erie Lighting Company and provide additional working capital	6½	97	6.80
Coast Counties Gas & Electric Co. (Cal.)	250,000	...	Cumulative first preferred stock	Improvements and refunding	6	86	6.98
Great Lakes Power Co. (Ont.)	320,000	20	First mortgage gold bonds, series A		6	97½	6.25
Potomac Electric Power Co. (D.C.)	4,000,000	30	General and refunding mortgage gold bonds, series B	Refunding and to reimburse for construction	6	101½	5.88
Pennsylvania-Ohio Power & Light Co. (Ohio)	2,000,000	3	Secured gold notes	Refunding and additions	6	99	6.35
American Public Service Co. (Ill.)	300,000	19	First lien gold bonds	To provide working capital	6	91½	6.80
Eastern Connecticut Power Co.	1,500,000	...	Cumulative first preferred stock	Extensions, purchase of securities and retirement of floating debt	7	100	7
Jersey Central Power & Light Corp.	3,500,000	25	First lien sinking-fund gold bonds, series A	General corporate purposes	6½	97	6.75
Kansas Gas & Electric Co.	3,500,000	29	First mortgage sinking-fund gold bonds, series A of 1922	Construction	6	95½	6.35
Power Corporation of New York	1,000,000	19	First mortgage sinking-fund gold bonds (series B)	Additions	6	94½	6.50
Utica Gas & Electric Co.	500,000	...	Cumulative preferred stock	Additions	7	102	....
Edison Electric Illuminating Co. of Boston	1,000,000	¾	Notes		5	...	....
Utah Power & Light Co.	3,500,000	21	First lien and general mortgage gold bonds	General corporate purposes	6	99	6.10
Metropolitan Power Co. (Pa.)	3,250,000	30	First mortgage gold bonds, series A	Construction	6	96	6.30
Total	$52,026,000						

* Due annually.

Supersystems for New York

Two Zones, 25-Cycle and 60-Cycle, Will Probably Be Necessary in Interconnection Schemes

THE plan outlined in considerable detail on page 741 of the ELECTRICAL WORLD for March 31 for interconnection of transmission systems in New York State and connection between New York State systems and those of other states was discussed at the recent Utica meeting of the Empire State Gas & Electric Association by E. P. Peck of the Utica Gas & Electric Company in the light of work done by a committee of the association just named. Mr. Peck said that there was no desire to try to force any recommendations the committee may make on any company, but only to make suggestions for future guidance when interconnection becomes an urgent question.

Owing to the large 25-cycle power system that exists in Niagara Falls and New York City, and because 60-cycle systems are used extensively in other parts of the state, it will probably be necessary in any plan of interconnection to divide the state into 25-cycle and 60-cycle zones. Niagara Falls could never be expected to change from 25 cycles to 60 cycles, because all its power development can be utilized locally and because the only help available to it is from the 25-cycle system across the river. The 25-cycle system in the metropolitan district will never be embarrassing because it is used almost exclusively for railways. For immediate needs it would be adequate to the purpose in view to construct 66,000-volt lines for the interchange of energy, but the towers should be designed for 110,000 volts with more distant requirements in view.

LOAD-DISTRIBUTION COMMITTEE'S WORK

Considerable work has been done by the load-distribution committee in studying magnitude of loads in different centers, the distances between these loads and between generating stations, the distances between adjacent systems and the amount of power which may be required for interchange, and the most desirable voltage, Mr. Peck said. A map showing the results of this study, as well as systems in adjoining states with which it may be desirable to interconnect some day, is in preparation. The cost of making these interconnections is also being thoroughly studied.

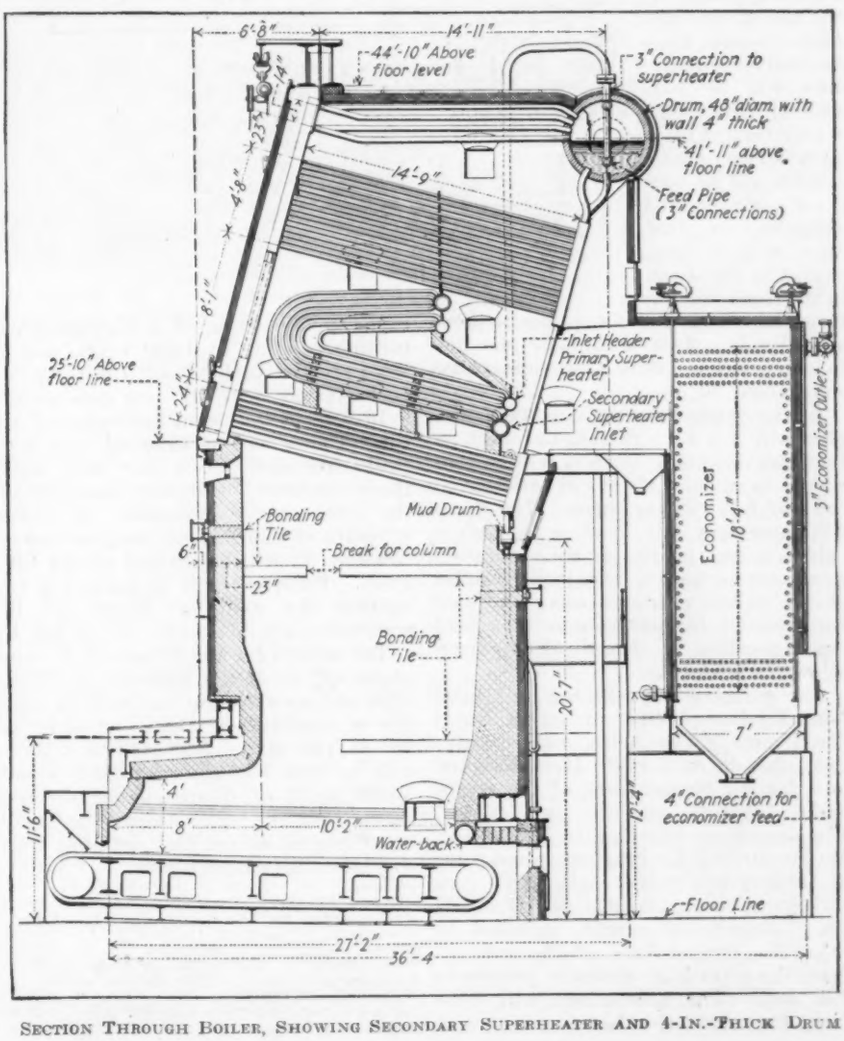
If interconnections are anticipated, declared Mr. Peck, the ultimate expense will be greatly reduced and interconnection hastened. With several sources of emergency supply, the small plants will benefit by interconnection through the assurance of more reliable service. Contrary to the usual impression, low-voltage ties can be used to exchange energy between distant companies without the equivalent transmission loss, because the company nearest the system which has surplus power can utilize that energy in its own system and transmit its power on to the next system and so on, thus relaying the energy to the company which is in need of power. Neither does the plan contemplate parallel operation. Only in emergencies will the companies be connected together. After the engineering problems have been solved and contractual relations settled by executives, the chief problem will be one of load dispatching or adjustment of frequencies and voltages. This problem will be minimized if a friendly spirit is stimulated among the various load dispatchers and their activities are co-ordinated. In its present construction work as well for the future the Utica Gas & Electric Company is planning for such interconnections, as are other companies.

Commonwealth Edison Innovations

Experimental Installation Using Steam at 1,200 Lb. Pressure to Be Made in Calumet Station—Design for Turbine Lay-out in Crawford Avenue Has Unusual Features

AN EXPERIMENTAL installation of a boiler designed for an operating pressure of 1,200 lb. per square inch is to be made at the Calumet station of the Commonwealth Edison Company, Chicago. With it will be coupled a small extra-high-pressure turbine exhausting at 300 lb. pressure into the steam mains which supply the large turbines of the station. The turbine has not yet been ordered and the details of the system have not been completely worked out. The details of the boiler design, however, have been practically completed by the Babcock & Wilcox Company in conjunction with the consulting engineers of the Commonwealth Edison Company.

The unit will be of the inclined-header, cross-drum type and comprise a lower deck of 2-in. tubes in sections eight high, having a setting height of 25 ft. 9¾ in., a primary and a secondary superheater in an interdeck space 8 ft. 1¼ in. between decks, an upper deck of seventeen-high sections of 2-in. tubes, horizontal 3¾-in. circulating tubes entering a 48-in. cross-drum, and a Babcock & Wilcox steel contraflow economizer. The lower deck will not be baffled, but the upper deck will have a vertical baffle, causing the gases to

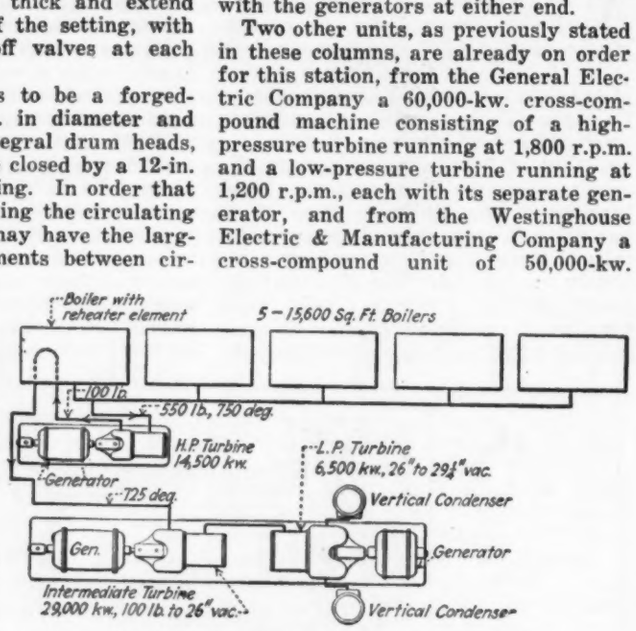


SECTION THROUGH BOILER, SHOWING SECONDARY SUPERHEATER AND 4-IN.-THICK DRUM

make two passes. The complete unit is to be about 28 ft. wide and 36½ ft. deep, including the economizer, and 45 ft. high above the floor. The heating surfaces have not yet been definitely fixed, but they will be approximately as follows: Boiler, 15,750 sq.ft.; primary superheater, 2,120 sq.ft.; secondary superheater, 3,300 sq.ft.; economizer, 9,230 sq.ft.

The headers will have 1¼-in. thickness front and back and ⅝-in. sides, and are designed to give the tubes a stagger of nearly 4 in. The eight tubes in each section of the lower deck are to be expanded into nine-high headers, the tube space not filled being that next to the bottom. The mud drum is to be 7¼ in. square, 1 in. thick and extend through each side of the setting, with a flange for blow-off valves at each end.

The cross-drum is to be a forged-steel cylinder 48 in. in diameter and 4 in. thick, with integral drum heads, each with a manhole closed by a 12-in. x 16-in. manhole fitting. In order that the holes for connecting the circulating tubes to the drum may have the largest practicable ligaments between circumferential rows of holes, an unusual arrangement of connections has been adopted. At the top of each uptake header two horizontal circulators will be connected, but the circulators from each alternate header will be bent downward and sidewise so that they will be connected to the drum in the same circumferential row as the circulators without such bends. This will make the distance between these circumferential rows about 16 in.



ARRANGEMENT OF 50,000-KW. PARSONS UNIT

In the same way, the downtake nipples will not be straight, but bent so that two downtake headers will be connected to each of these circumferential rows of holes in the drum. The drum will have four 3-in. nozzles for safety valves, a 3-in. nozzle for the saturated-steam connection to the lower header of the primary superheater, and two 3-in. nozzles for connections to a feed pipe extending the length of the drum below the water line.

The primary superheater will have 8-in. headers drilled for three staggered rows of tube holes, with seventy-two tubes in each row. It is designed to raise the temperature of the steam under 1,200 lb. pressure to 750 deg. The secondary superheater has 11¾-in. headers drilled for four staggered rows of seventy-two tubes each. This secondary superheater incloses the primary superheater and is intended to raise the temperature of the exhaust from the extra-high-pressure turbine to 750 deg. The economizer will have forty-four rows of tubes.

Arrangement of Parsons Turbine in Crawford Avenue

An unusual arrangement will characterize the 50,000-kw. unit which C. A. Parsons & Company of England are building for the new Crawford Avenue station of the Commonwealth Edison Company. This unit will consist of three turbines, a 14,500-kw. high-pressure element running at 1,800 r.p.m., a 29,000-kw. intermediate turbine running at 1,800 r.p.m. and a 6,500-kw. low-pressure turbine running at 720 r.p.m. Each will have its separate generator, but the intermediate and low-pressure turbines will be arranged in tandem on the same bedplate with the generators at either end.

Two other units, as previously stated in these columns, are already on order for this station, from the General Electric Company a 60,000-kw. cross-compound machine consisting of a high-pressure turbine running at 1,800 r.p.m. and a low-pressure turbine running at 1,200 r.p.m., each with its separate generator, and from the Westinghouse Electric & Manufacturing Company a cross-compound unit of 50,000-kw. capacity, consisting of a high-pressure turbine running at 1,800 r.p.m. and a low-pressure turbine at 1,200 r.p.m., each element with its own generator.*

Instead of the usual arrangement all the turbines will be supplied with vertical condensers, two for each unit, these condensers standing alongside of the low-pressure cylinders. A steam pressure of 550 lb. and temperature of 750 deg. F. will be carried at the turbines. Provision will be made for reheating the steam at about 100 lb. pressure to a temperature of 725 deg. F.

The boilers for the Crawford Avenue plant will be of the Babcock & Wilcox high-pressure design, but will be built for a maximum working pressure of 650 lb. per sq.in. For each unit there will be five boilers, each with about 15,600 sq.ft. of steam-making surface, except that one boiler on each unit will be of special design and equipped with the interstage superheater.

*Adding the ratings of the three units under order by the Commonwealth Edison Company, a total of 160,000 kw. is found, which should be substituted for the 70,000 kva. given in the table on page 1231 of last week's issue. The figure given for Calumet—60,000 kva.—was also an underestimate, new equipment under order reaching 67,000 kw.

The Crawford Avenue station is being laid out for an ultimate rating of 500,000 kw. or possibly 600,000 kw.

Electric Power Club Issues June Program

The program for the annual meeting of the Electric Power Club, to be held at The Homestead, Hot Springs, Va., on June 11-14, has just been issued. In addition to the section meetings and the usual reports from the officers and committees, C. L. Collens, 2d, will discuss the accomplishments of the Electrical Manufacturers' Council and tell what happened at the Geneva meeting of the International Electrotechnical Commission, A. M. MacCutcheon will deal with technical standardization, E. R. Harding with commercial standardization and A. H. Moore with Electrical Safety Conference activities. A. L. Ashby of the Westinghouse Electric & Manufacturing Company will make an address on "Contracts," and R. W. Gardner will speak on "Waste Prevention in Manufacturing."

At a dinner to be held on Tuesday evening F. M. Feiker of the McGraw-Hill Company will talk on "New Tasks for a Manufacturers' Association." Entertainment plans include golf tournaments, tennis, driving and riding, mountain climbing and dancing.

Standardizing Pipe Joints

At an informal conference held in New York City last week between representatives of manufacturers and users of pipe flanges, engineers and others concerned, in the interest of standardization, a letter was read from C. F. Hirshfeld of the Detroit Edison Company, chairman of the prime movers committee of the National Electric Light Association, asking, on behalf of that association, that an agreement be reached for various pressures and temperatures covering allowable working stresses of different materials, gasket pressure, specifications for material and methods of testing, and the rational pressure for which standards should be specified.

Users of pipe fittings as well as manufacturers recommended that in standardizing fittings as few sizes be used as practicable. This means fewer patterns for the maker and fewer spare parts for the power plants. New standards appeared desirable. A method of reducing the number of standard fittings strongly advocated was to standardize the outside diameter of pipe for a given size and vary the internal diameter to suit pressure conditions. This would make one, or possibly two, standard flange diameters possible, from 250 lb. to 1,200 lb.

A motion was passed that pressure standards of 250, 400, 600, 800 and 1,200 lb. be recommended. The need of haste was emphasized, as in some cases fittings for 600 lb. and higher were being made with no official standards to follow.

Electric Truck Show Will Be Held Convention Week

New York's annual electric truck show will be held in the Irving Place showroom of the New York Edison Company from June 2 to 9. More than twenty manufacturers of trucks and accessories have accepted the company's invitation to exhibit. A newcomer will be the Autocar Company. This company has just added an electric model to its line which will be exhibited for the first time at the truck show.

In the accessory exhibits will be shown new charging apparatus, which, according to Charles R. Skinner, Jr., manager of the automobile bureau of the New York Edison Company, will make the charging of electric truck batteries as simple a matter as connecting an electric flatiron.

An electric truck session forming part of the N. E. L. A. convention will be held at the Commodore Hotel on Monday afternoon, June 4. Among the speakers announced are E. S. Mansfield of Boston, who will report for the electric vehicle school committee; Charles S. Morris, past-president of the National Furniture Warehouse Association; Col. John Stilwell, general superintendent of transportation, Consolidated Gas Company, and William Van C. Brant of the Electric Storage Battery Company.

Progress of Electric Arc Welding

At a recent meeting of the electric arc welding committee of the American Bureau of Welding, the sub-committee on arc welding of cast iron gave a description of hardness tests which had just been completed. These tests, carried out in accordance with a prearranged program, indicated that the hard zone exists in the cast iron near the junction line, not in the deposited metal.

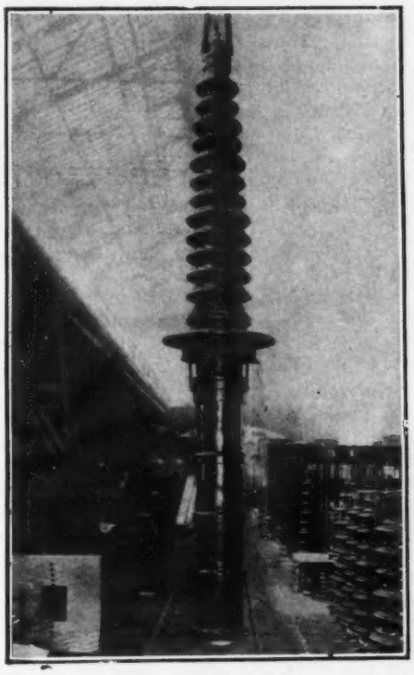
The arc welding of non-ferrous metals was discussed, and a sub-committee with O. H. Eschholz of the Westinghouse Electric & Manufacturing Company as chairman was appointed to prepare a summary of the art to date and lay out a program of research. Specimens are to be welded by various companies and sent to Union College, Schenectady, for test.

Harold Ewertz was appointed to collect data and prepare a summary on the subject of the speed of welding and its effect on the weld. No definite program of investigation of the arc welding of thin-sheet metal was laid out, but R. E. Wagner was appointed to collect such data as could be obtained.

The subject of the application of arc welding to structural steel work was discussed, and it was decided that test specimens would be prepared by several welding companies and tested if possible at Union College. Specifications for these tests are to be prepared under the direction of H. M. Hobart.

Brief News Notes

Large Bushing for City of Seattle.—The accompanying photograph shows what is probably the largest roof bushing ever manufactured. It weighs 2,600 lb., has an over-all length of, roughly, 17 ft. and is designed for a normal voltage of 187,000. It is one of four built by the Westinghouse Electric & Manufacturing Company for the Skagit River development of the city of



Seattle. Three of the bushings will be used for connecting a 165,000-volt bus line with a bank of three 10,000-kva., single-phase transformers, and the fourth will be used as a spare.

Tirso River Reservoir Completed.—Consul Russell reports from Rome that the hydro-electric reservoir on the Tirso River in Sardinia is completed and is now being filled. This artificial body of water will have an area of 19.305 square miles and will contain 460,000,000 cu.m. of water. It is calculated that this storage will produce 50,000,000 kw.-hr. of electrical energy for industries and will irrigate 74,000 acres of land.

Insulator Tests at Purdue University.—On May 15 and 16 insulator tests were carried out in the high-voltage laboratory of Purdue University, Lafayette, Ind., under the direction of Prof. C. F. Harding, head of the electrical engineering department. These tests were witnessed by engineers from Pittsburgh and New York City and also by Prof. H. B. Smith, head of the department of electrical engineering at Worcester Polytechnic Institute.

Radio Monopoly in Great Britain Unpopular.—The broadcasting monopoly in Great Britain has become so irksome to the public that a change of policy would cause no surprise, say recent advices reaching this country, particularly since the new Postmaster-General is apparently not in full sympathy with the plan. The control has been far from complete as evasions are known to be many. It is estimated that there are fully two hundred thousand unlicensed receiving sets in the British Isles.

Bristow, Okla., Increasing Capacity.—Owing to rapid increase in load, the Bristow substation of the Oklahoma Gas & Electric Company will again be enlarged. Three transformers rated at 500 kw. will replace others of 200-kw. capacity. This will require a rebuilding of the high-tension line now feeding the locality. The new line will have a voltage of 63,000. Three years ago the capacity of this substation consisted of three 75-kw. transformers, which served 340 consumers. The number of consumers is now 1,400.

Fifty Iowa Cities Abandon Municipal Ownership. — Fifty Iowa cities and towns which formerly had municipal electric lighting plants have abandoned them and are receiving their electrical energy from privately operated companies, according to records compiled by the Iowa Committee on Public Utility Information. There are fifty-eight cities and towns which have municipally owned distributing systems but which buy their energy wholesale from the lines of privately owned companies or from other towns, which have municipal lighting plants.

Development on the Rio Grande.—The Colorado and New Mexico Legislatures passed laws at their recent sessions authorizing the formation of a joint state commission to draft a compact between the two states relative to the use of water from the Rio Grande River. Governor Sweet of Colorado has appointed Delph E. Carpenter as the commissioner from Colorado. Mr. Carpenter favors the removal of embargoes placed on the use of the river water by the Department of the Interior to assure the rights of federal reclamation projects to the south.

For Better Lighting in Mountain States.—The local branch of the Association of Electragists International has established a lighting service bureau with headquarters at the office of the Rocky Mountain Electrical Co-operative League to promote better understanding and application of the best practice in lighting. The members of the bureau staff are E. A. Evans of the Westinghouse Lamp Company, Ernest L. Dee of the Edison Lamp Works and S. S. Stevens, representing the Bryan-Marsh Division of the National Lamp Works.

New Library for Franklin Hall.—The Electrical Engineering College of Cornell University has just been equipped with a library for the use of the students as a memorial to the late Prof. Alexander Gray, formerly its head. The McGraw-Hill Book Company purchased the books of Professor Gray after his death and gave them to the college. Along with this gift the company gave a copy of each of the tech-

nical books that it publishes. A classroom in Franklin Hall has now been set aside for their proper arrangement and access.

Twelve-Hundred-Foot Submarine Cable Laid in Seven Minutes.—The Northwestern Electric Company of Portland, Ore., recently laid a 1,200-ft., 250,000-circ.mil, 13,200-volt submarine cable across the Willamette River at Portland in the remarkable time of seven minutes. This was accomplished by laying one length of cable in a figure eight on the barge and splicing to this another length on a reel before the cable-laying operation was started. It was found preferable to use two tugs instead of one where the current of the river is swift because of the greater ease in controlling the barge.

Electrical Spectacle Planned for Denver Exposition.—Members of the electrical industry in Denver have taken preliminary steps to arrange for a spectacular electrical display at the "Pageant of Progress" to be held in that city in July and have called into consultation William D'Arcy Ryan, head of the illuminating laboratories of the General Electric Company. The Denver Electrical Co-operative League will handle the electrical end of the pageant, and all of the electrical men in the city will work through the league. The plans at present call for an iridescent color scheme of illumination throughout the exposition grounds.

North American Company to Control Wisconsin Utility.—The North American Company of New York has purchased nearly all of the capital stock of the Wisconsin Traction, Light, Heat & Power Company, which furnishes electric light and power, street-railway, interurban and gas service in the cities of Neenah, Menasha, New London, Bear Creek and Appleton, Wis. Most of the capital stock of the Wisconsin utility has been held by John I. Beggs and associated Milwaukee capitalists. No information was given out as to the price paid. No change in the management or operation of the property will result from the transfer.

Northwestern Electric Company to Install Large Motor-Generator Set.—An order has just been placed by the Northwestern Electric Company of Portland, Ore., for a 2,500-kw. motor-generator set consisting of one 3,600-hp., 11,000-volt, three-phase synchronous motor, directly connected to two 1,250-kw., 275-volt direct-current generators. The unit will operate at 720 r.p.m. It will be installed in the company's Pittock substation and will bring the total direct-current generating capacity up to 7,000 kw. The new machine is being built by the Westinghouse Electric & Manufacturing Company and will be, it is said, the largest motor-generator set of its kind on the Pacific Coast.

Rural Service Projected by Tucson Company.—A tentative offer to finance the construction of a hydro-electric power line that will bring cheap energy to the farming districts of Pima County, Ariz., and to sell the farmers power at 2¼ cents per kilowatt-hour, has been made by the Federal Light & Traction Company of New York, parent company of the Tucson Gas, Electric Light & Traction Company. In making this proposal the president of the Federal company asserts that the company has no desire to make more than a fair return on an investment of this character, realizing the indirect benefit that will accrue to its city business by the greater development of agriculture in the neighborhood of Tucson.

Contest Over Ownership of Former Municipal Plant in Indiana Town.—A vigorously waged three-cornered utility contest is awaiting final decision from the Indiana Public Service Commission. Cambridge City (Ind.) voters decided recently that the municipal electric plant should be sold for private operation and at a public sale Robert Ashe bid $10 more than the Interstate Public Service Company. The city accepted Ashe's bid, and the transaction has come before the commission for approval, the Interstate filing a petition for a certificate of convenience and necessity with the commission and asking the right to intervene. The commission indicated that it would rule the Interstate had no right to intervene, but reserved decision on the question of which applicant should have the property.

Holyoke Will Rebuild Municipal Plant.—The Holyoke (Mass.) Gas & Electric Commission has decided to rebuild the municipal electric plant on its present site and abandon for the time being the project of a new site and a larger plant, for which a million-dollar bond issue was considered. The alternative plan of continuing the municipal plant at its present capacity and buying additional energy from the Holyoke Water Power Company or some other source did not command strong support. It is estimated that the arrangement decided on will take care of the department's business for the next five years. The commission has voted to accept the Holyoke Water Power Company's offer of a permanent connection between its plant and the city's. New waterwheels and turbines will be installed to meet the requirements of the department.

Milwaukee Company Seeks to Acquire Waukesha Utility.—The Wisconsin Gas & Electric Company, Racine, a subsidiary of the Milwaukee Electric Railway & Light Company, has applied to the Wisconsin Railroad Commission for authority to issue $400,000 of serial notes for the purpose of paying in part the purchase price of the electric and gas plants of the Waukesha Gas & Electric Company, which furnishes electricity for light and power purposes to a population of nearly 13,000. The plants of the company are about 25 miles from Milwaukee and 35 miles from Racine. At present the output of the steam plant of the Waukesha company is supplemented by energy from a high-tension transmission line from the Lakeside plant of the Milwaukee company. The Waukesha Gas & Electric Company is owned by the American Gas Company of Philadelphia.

Associations and Societies

Canadian Electrical Association.—This association will hold its annual meeting in Montreal on June 21-23, and the convention committee announces an original feature in the shape of a "veterans' night," to be held on the evening of June 22. The minimum qualification for participation is twenty years in the electrical industry, but with this limitation a widespread invitation is extended to pioneers everywhere and many acceptances have already been received.

Chicago Section, A. I. E. E.—The development of vacuum tubes in power service was discussed on May 21 by Dr. A. W. Hull, General Electric Company, before a joint meeting of the Western Society of Engineers and the Chicago Section, A. I. E. E. He dwelt upon the fundamental characteristics of vacuum tubes, which he explained with slides. Dr. Hull also spoke of the 1,000-kw. power tube, but declared that some time would elapse before this tube could be standardized sufficiently to warrant its manufacture.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

California State Association of Electrical Contractors and Dealers—Dorner Lake, Cal., June 9-16.

Electric Power Club—Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

North Central Division, N. E. L. A.—Minneapolis, June 20-22. H. E. Young, Minneapolis General Electric Company.

Society for the Promotion of Engineering Education—Ithaca, N. Y., June 20-22. F. L. Bishop, University of Pittsburgh.

Canadian Electrical Association—Montreal, June 21-23. Louis Kon, 65 McGill College Ave., Montreal.

American Institute of Electrical Engineers—Annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

American Society for Testing Materials—Atlantic City, June 25-29.

Iowa Section, N. E. L. A.—Mason City, June 26-29. M. A. Linn, Des Moines Electric Co., Des Moines.

Associated Manufacturers of Electrical Supplies—New London, Conn., June 26-29. Frederic Nicholas, 30 East 42d St., New York.

National Council Lighting Fixture Manufacturers—Buffalo, June 26-28. C. H. Hofrichter, 233 Gordon Square Bldg., Cleveland.

Northwest Electric Light and Power Association—Seattle, June 27-30. G. E. Quinan, 204 Electric Bldg., Seattle.

Ohio Electric Light Association—Cedar Point, July 10-13. D. L. Gaskill, Greenville.

New England Division, N. E. L. A.—Swampscott, Mass., Sept. 6-8. Miss O. A. Bursiel, 149 Tremont St., Boston.

Michigan Electric Light Association—Grand Rapids, Sept. 11-13. Herbert Silvester, Detroit Edison Co., Ann Arbor.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 17-19. O. A. Weller, 900 15th St., Denver.

Association of Iron and Steel Electrical Engineers—Buffalo, Sept. 24-28. J. F. Kelly, 513 Empire Bldg., Pittsburgh.

Recent Court Decisions

Powers of Tennessee Commission.—The United States District Court for the Middle Division of Tennessee has held, in Cumberland Telephone & Telegraph Company vs. Railroad and Public Utilities Commission of Tennessee, that an order of the commission suspending increased rates for an indefinite period until the commission should determine the matter was invalid in so far as it suspended the rates for an indefinite period that might continue more than three months after the effective date of the increased rates, but was valid in so far as it suspended the increased rates for such three months' period. Where existing rates asserted by a public utility to be confiscatory have not been imposed on it by any act of the commission, but were voluntarily established by the utility itself with the approval of the commission, and the utility gives notice of an increase in rates, enforcement of an order of the commission suspending the increased rate pending a reasonable period of investigation will not be enjoined on the ground that the existing rates are confiscatory and in conflict with the United States Constitution. (281 Fed. 406.)*

Three-Year Contract Between Utility and Consumer in Oklahoma Invalid and Cannot Be Validated by Commission.—In Southern Oil Corporation vs. Yale Natural Gas Company the Supreme Court of Oklahoma has declared invalid a three-year contract by which the defendant agreed to sell and deliver its product at a specified rate to the plaintiff. The court found that rates so fixed were binding on neither party, the Corporation Commission having been established to determine rates of all public utilities, and that the commission could fix a different rate at any time. The fact that when the contract was first brought before the commission that body held that it did not establish discrimination, as claimed at that time by the oil corporation, was not tantamount to approval of the three-year rate by the commission, and its more recent order establishing a higher rate did not impair the obligation of a contract. The Corporation Commission, moreover, was not vested with the power to approve contracts, but was charged with the duty of fixing and establishing rates in the manner provided by law. (214 Pac. 131.)

City Cannot by Inaction Continue Confiscatory Rates at Its Pleasure.—In City of Wagner vs. South Dakota Light & Power Company the Supreme Court of South Dakota was called on to adjudicate an action for injunction brought by the plaintiff city against the defendant public service corporation to prevent it from charging rates for electricity in excess of the maximum rates specified in its franchise. The company, finding itself unable to continue service at existing rates without loss, sought permission to increase its charges, which was granted by all the cities on its lines except Wagner. That city did not controvert the company's assertion that it must have an increase in rates or discontinue its business. The Supreme Court sustained the Circuit Court in dissolving a temporary injunction obtained by the city, saying: "The issue on that question is simple. On the part of plaintiff we have the presumption that the franchise rates are reasonable. On the part of defendant we have the undisputed showing that they are unreasonable and confiscatory. A presumption cannot stand against such showing. The city contends that the franchise rates must be continued unless and until it changes them regardless of whether they are or are not confiscatory. Such is not the law. The city cannot by inaction and by refusal to adopt reasonable rates continue confiscatory rates in effect at its pleasure, and it matters not whether the question arises in an action brought by the city or in an action brought by the public service company." (193 N. W. 129.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Municipal Tax on Poles Condemned.—An ordinance imposing upon a telephone utility a charge for each pole maintained in the streets of a city was declared by the Indiana Public Service Commission to be unlawful, unreasonable and void, in an instance where a municipality sought to impose such a tax on the Citizens' Independent Telephone Company. In addition to holding that the municipality had no power to impose such a burden the commission said: "It cannot be said that the question is of no moment because the taxes go to the municipality and the service is rendered to the people who live in the city, for the reason that the taxpaying public is a separate and distinct unit from the utility-using public receiving service from the petitioner. There are some taxpayers who are not patrons of the petitioner, and there are large taxpayers receiving only a small amount of service, and there are small taxpayers receiving a large amount of service from the utility. To permit a charge or tax of this kind would be to lift a burden which has been fixed by law upon the taxpaying public of the city and to place it upon the patrons of the petitioner, because such added burden would necessarily be reflected in the rates to be charged by petitioner. Before the days of regulation, when cities and towns had the absolute power to grant or refuse franchises, it was possible to affix to a franchise hard conditions which the utility must meet or be banished from the city or town, and these conditions were binding, not on the ground of regulation but on the basis of contract. When the franchise has been surrendered the conditions attached go out with the franchise and are no longer binding upon the utility."

Steam-Heating Service from Electric Plant.—Combating the prevailing opinion that the furnishing of central-station steam-heating service in conjunction with the generation of electric power is a function which involves practically no effort or expense on behalf of a central-station operator, and that such use of steam represents a use of something that would otherwise be wasted, the Public Utilities Commission of Michigan said, in fixing steam-heating rates for the Lapeer Gas-Electric Company: "The value and desirability of central-station steam heating does not develop from its cheapness, but from relieving the customer from the necessity of worrying over his coal supply, the stoking of his furnace, the removal of his ashes and the dirt and discomfort caused to him, his family or patrons by the presence of the individual heating plant in his residence or place of business. When accurate or approximate money values are placed on these various benefits, it is usually found that the central-station service is as cheap as, or cheaper than, isolated heating service with its attendant worries and discomforts. The electric power generating plant at Lapeer is a thoroughly modern installation of medium-pressure, high-speed engines operated condensing. Such operation secures nearly the greatest possible efficiency from the coal burned under the boilers that can be secured in a plant of such size. During the heating season, however, the condensing feature of the generating plant must be sacrificed in order to obtain steam at sufficient pressure to supply the heating customers. In sacrificing the condensing feature of operation the amount of coal required per kilowatt-hour of power generated is substantially increased, and the cost of generating the electric power is increased correspondingly. An analysis of the operating results during the various seasons of the year indicates that almost one-third of the coal consumed at Lapeer is consumed for the purpose of providing steam for the heating service. In other words, if no heating service were furnished, one-third less coal would be needed than actually has been consumed in the past years. In addition, boiler-house labor must necessarily be higher with this steam-heating coal to be handled than would be required to handle electric generation only. . . . Probably the total collections from heating customers have been less than the fair and reasonable expenditures necessary in rendering the service. The resulting deficit has been borne by the lighting and power customers, many of whom are not heating customers."

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

Julian C. Smith Heads Quebec Company

Julian C. Smith, who has been elected president of the Quebec Railway, Light, Heat & Power Company, as was announced in the May 26 issue of the ELECTRICAL WORLD, has been a prominent figure in Canadian hydro-electric developments during the past few years. Besides occupying the chief executive office of the Quebec company, Mr. Smith is vice-president and general manager of the Shawinigan Water & Power Company of Montreal, president

International Press Service
J. C. SMITH

of the Public Service Corporation, Quebec; president of the Canada Carbide Company, vice-president of the Dominion Engineering Works, Ltd.; director of the Dominion Bridge Company and president of the Canadian Electro-Products Company and North Shore Power Company, Three Rivers, Quebec.

Mr. Smith was born in Elmira, N. Y., in 1878 and was graduated from Cornell University in 1900. He began his business career as draftsman with Wallace C. Johnson, consulting engineer at Niagara Falls, N. Y., and later went to Shawinigan Falls, Quebec, as assistant engineer to Mr. Johnson. In 1903 he allied himself with the Shawinigan Water & Power Company as superintendent and three years later was advanced to general superintendent. Subsequently he became general superintendent and chief engineer, and in 1913 he was made vice-president. At present, in addition to his position as vice-president and general manager of the Shawinigan company, he is executive of all subsidiary companies. Mr. Smith has taken an active interest in engineering societies—American, Canadian and British—and has made many important contributions to technical literature. Interests which are identified with the Shawinigan company have recently acquired control of the Quebec company. Several of the old directors of the latter resigned, and their places were filled by officials representing the Shawinigan company.

E. W. Robinson, formerly assistant chief engineer of the E. W. Clarke & Company Management Corporation at Columbus, Ohio, has joined the Alabama Power Company, Birmingham, in the capacity of assistant superintendent of distribution.

A. H. Kendall, master mechanic of the Quebec district of the Canadian Pacific Railway, has resigned to become manager of the Chicoutimi Pulp Company, the Saguenay Light & Power Company and the Roberval & Saguenay Railway Company, Chicoutimi, Que.

Frederick H. Hill, vice-president and general manager of the Elmira Water, Light & Railroad Company, completed ten years of service with the company on May 12, when he was presented by his associates with a silver service. Three hundred employees attended the dinner which preceded the presentation.

N. I. Garrison, manager of the El Reno division of the Oklahoma Gas & Electric Company, has been appointed manager of the southern division of the company, with headquarters at Ada, Okla. J. T. Naylon, from the commercial department of the Oklahoma City division, succeeds Mr. Garrison as manager at El Reno.

John T. Sharp, Jr., for several years superintendent of the Canton (Miss.) Light & Water Works Plant, tendered his resignation on May 1 to take effect as soon after May 15 as possible to accept a position as manager of the Helena (Ark.) Gas & Electric Company. The Helena property is owned by the Arkansas Utilities Company.

F. F. Winfree, electrical engineer at the head offices of the Mountain States Power Company, Albany, Ore., has assumed control of the Eugene office. Mr. Winfree is taking the place of Fred Brown, who leaves for Tacoma, Wash., and will be stationed in Eugene only until a resident engineer can be obtained to take charge of the company's properties in Lane County.

W. H. Damon of Madison nas been appointed to succeed E. J. Steinberg, whose resignation became effective June 1, as resident engineer in Milwaukee for the Wisconsin Railroad Commission. Mr. Damon has been with the Railroad Commission for approximately ten years and served as resident inspector in both the Eau Claire and Appleton districts prior to his promotion to his present position at Madison. His work in Milwaukee will consist largely of investigations of the service of the electric, street-railway, gas and telephone utilities.

Eugene B. Criddle Vice-President Southern Sierras

Eugene B. Criddle, who was made a vice-president of the Southern Sierras Power Company at a recent meeting of the board of directors, as was announced in the May 5 issue of the ELECTRICAL WORLD, entered the public utility field in 1911, when he became associated with the Nevada-California Power Company and the Southern Sierras Power Company. After serving as manager of the northern district for two years he was made general agent of these companies with headquarters at Riverside, Cal. He continued in this capacity until the promotion just referred to. Before engaging in utility work Mr. Criddle spent some time in managerial positions with industrial concerns and gained an extensive training in drafting, railroad rate making and shop work.

E. B. CRIDDLE

H. W. Watt, electrical engineer of the Westchester Lighting Company, Mount Vernon, N. Y., was elected vice-chairman of the electrical section of the Empire State Gas & Electric Association at its meeting in Utica on May 18. He had previously been chairman of the overhead-distribution committee. Mr. Watt has been connected with the Westchester company for about fifteen years.

Frank D. Fagan, vice-president and general manager of the Edison Storage Battery Company for the past three years, has been selected to go on a special mission to Japan for the International General Electric Company. Mr. Fagan has risen from the ranks of the General Electric Company and is the originator of many remarkable ideas in connection with the sale of incandescent lamps. He sailed on May 17.

Eric A. Lof Leaves Schenectady

Eric A. Lof, who since 1909 has been connected with the power and mining engineering department of the General Electric Company as industrial engineer and specialist, has resigned to take up work with the American Cyanamid Company, one of the Duke interests. He will have important tasks in connection with the electrochemical projects that form part of the large water-power developments now in progress on the Saguenay River above Quebec, Canada. His headquarters are in New York City, and he assumed his new duties on June 1.

Mr. Lof became associated with the General Electric Company in 1909 when the power-apparatus section of the Western Electric Company, with which he was connected, was taken over by the first-named company. He spent several months in Europe two years ago for the International General Electric Company, partly in connection with the extensive power transmission and railway electrification projects in Sweden and Norway. About a year ago the Royal Order of Vasa was conferred on him by the King of Sweden in recognition of services rendered to the Swedish government. He is well known to the engineering profession through his many contributions to the technical press, his frequent lectures on various subjects and as the author of several books.

P. T. Sealey, formerly superintendent of power for the Potomac Public Service Company, Hagerstown, Md., is now superintendent of the Southern Utilities Company, Palatka, Fla.

Jason C. Leighton of the Boston office of Stone & Webster, Inc., has been made vice-president of the El Paso (Tex.) Electric Company to succeed Donald C. Jewett.

C. E. Brenton has been appointed general manager of the Missouri Public Utilities Company, St. Louis, having charge of the operations of the properties which have been leased to the Union Electric Light & Power Company of the same city.

Walter Byrne, who has been sales manager of the Nebraska Power Company since 1919, has resigned to become assistant treasurer of the Thomas Kilpatrick Company. Kenneth Goewey, who has been closely associated with Mr. Byrne in the sales department, has succeeded him as sales manager. Mr. Goewey joined the Nebraska Power Company in 1917 as a heating specialist from the research laboratories of the General Electric Company. Previous to his association with that company he was with the Milwaukee Electric Railway & Light Company.

L. L. Price, who for the past three years has been manager of the gas and electric appliance department of the Winnipeg (Manitoba) Electric Railway Company, has just been appointed superintendent of distribution and sales, including the sale of all by-products. While this new position involves large responsibility, Mr. Price will still maintain charge of the appliance department. He is well qualified for the responsibilities of his new office, having had seventeen years' practical experience in utility accounting, office management, shop, distribution and merchandising of gas and electric appliances.

J. H. Gill Heads Southern Association

Joe H. Gill, who was elected president of the Southwestern Public Service Association on May 17 at the annual convention of the association at Fort Worth, Tex., is assistant general manager of the Dallas Power & Light Company and is one of the younger men in Texas who have risen rapidly in the electrical industry. Mr. Gill was born at Kerrville, Tex., in 1886 and was graduated from the University of Texas

J. H. GILL

in 1910 with the degree of electrical engineer. After receiving his degree from the university he joined the forces of the General Electric Company at Schenectady, N. Y., and remained with this company until 1912. Subsequently he allied himself with the Texas Power & Light Company of Dallas, where he served first as resident engineer in charge of transmission-line and distribution-line construction and later as supervisor of transmission lines in entire charge of all construction of this character undertaken by the company.

Mr. Gill was with Stone & Webster from October, 1917, to April, 1918, as electrical engineer on design of the American ordnance base depot in France, and in April, 1918, he enlisted in the United States Army. When his service was over he returned to Dallas, entering the employ of the Dallas Power & Light Company as power salesman on Feb. 1, 1919. He has been successively power salesman, chief engineer and assistant to the general manager and is at present assistant general manager. Mr. Gill is a member of the University Club and of the Technical Club of Dallas and president of the Electrical Club.

R. A. Haigh has been appointed sales manager of the Paducah (Ky.) Electric Company to fill the vacancy resulting from the transfer of R. A. Gordon to Pawtucket, R. I.

M. H. Hallenbeck, for the past six years a power engineer specializing in applications of electricity to the paper industry on the staff of the Westinghouse Electric & Manufacturing Company at East Pittsburgh and Boston, has opened offices as consulting engineer in the latter city.

Elbert G. Allen, formerly chief engineer of the Philadelphia Rapid Transit Company, is now in the Boston office of Stone & Webster, Inc., as consulting engineer. Mr. Allen returns to the Stone & Webster organization after about twenty years of service in its engineering activities, embracing electrical interests in many parts of the country.

Henry C. Peeples, formerly with the Puget Sound Power & Light Company and for several years attached to the engineering department of the Stone & Webster division of construction and engineering, and until recently connected with the Wenatchee extension, has gone to Indianapolis, where he will be engaged on the construction of a 75-mile steel-tower line between Indianapolis and Terre Haute.

Obituary

Charles Sigel, Jr., of the Nevada-California Electric Company and president of the Sigel Manufacturing Company of Denver, is dead, aged seventy-eight. Mr. Sigel was born in Hamburg, N. Y., and was for many years in the leather industry there.

Edwin F. Davis, formerly state electrician for twenty-five years and co-inventor of the Sing Sing electric chair with Harry L. Tyler of New York, died at his home in Corning, N. Y., on Saturday, May 26. Mr. Davis retired five years ago to return to his home in Corning.

William Jones, who had been a director of the Pacific Power & Light Company since its organization in 1910, died recently at his home on American Lake, near Tacoma, Wash. Mr. Jones was also president of the Cordova (Alaska) Light & Power Company and had been connected with a number of other companies. He was born in Stratford, Ontario, and was sixty-eight years of age.

Dr. Hans Goldschmidt, inventor of the widely known Thermit process for welding iron and steel and for producing high-grade metals and alloys and originator of many other scientific inventions, died suddenly in Baden-Baden, Germany, on May 20, after a stroke. Dr. Goldschmidt visited this country frequently and was president of the Goldschmidt Thermit Company, now the Metal & Thermit Corporation, from 1904 to 1916.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Action Needed to Prevent More Inflation

A Discussion of the Dangerous Drift of Advancing Prices—An Appeal for Active Propaganda to Safeguard Our Industry

By J. H. Fall, Jr.
Treasurer Benjamin Electric Manufacturing Company, Chicago

THE time apparently has come when manufacturers in the electrical and other industries should seriously consider and discuss what steps may be taken to nurture the widespread business activity now in existence. It is also imperative that steps be taken to initiate propaganda, so that in the event of a reaction setting in we may head off a repetition of the disastrous losses manufacturers were forced to assume by reason of wild cancellations in 1920 and 1921 respectively.

General Conditions Are Unsatisfactory

Renewed activity has brought with it increased expense of manufacture, which of necessity has forced the price of goods up. But in my judgment the advances in many lines have been too rapid and more than expense conditions warranted, and as a result the price level at the present time is on a basis which the most conservative thinkers regard as a secondary period of inflation.

As far as it is possible to analyze the general condition, stocks of material in the hands of distributors are light, for the reason that manufacturers had no large stock of finished goods on hand when the present activity started. Therefore orders accumulated more rapidly than it was possible to manufacture and deliver.

This has reacted in all directions, resulting in congestion, a situation not unlike that obtaining in the spring of 1920. For it will be remembered that in the fall of that year, when the bubble burst, manufacturers not only had tremendous amounts of money tied up in goods in process of manufacture, but in addition thereto were committed to the purchase of material several months ahead against accumulated orders on hand.

Almost over night a great mass of buyers apparently lost all sense of moral responsibility, cancellations became rampant, prices tumbled, manufacturers were forced to assume terrific losses. And all of this could have been in large measure avoided if each buyer had been willing to assume his particular responsibility.

A repetition of this situation should not again be permitted by manufacturers in the event that another reaction sets in from the present nation-wide activity. Yet one will almost certainly be precipitated unless the large and basic corporations which have been so boldly announcing wage and price advances face about and change their policy by contributing something constructive to prevent prices from going higher and if possible stabilize them where they are.

Price Advances Dangerous

It is the opinion of the largest bankers and of the ablest leaders in the electrical industry that this price advance has been entirely too rapid and has become obnoxious. The steel corporation a few weeks ago made an announcement through the public press of a wage advance. This was followed by the packers and other basic industries with price advances in one form or another. These mean just further contributions to the vicious circle of wages followed by price advance, all of which, if something is not done, may result in the end in another smash similar to that of 1920.

What these people hope to gain heaven only knows, for we, their customers, do not. We do know this, however, that signs of hesitancy on the part of buyers are already appearing and appearing rapidly, and unless this policy is changed and prices are held at April 1 levels, we are all riding for a fall, and with it will be accomplished the death of "the goose that lays the golden egg."

I believe in all earnestness that the business men of America should register an objection to such price advances and appeal for a general announcement from manufacturers of these basic products that prices will remain firm at the April 1 level with no advance or decline contemplated for the rest of 1923.

In our judgment, this will contribute more toward a steadying of the present uncertainty than anything else. The General Electric Company recently reduced the price of some of its products 10 per cent as a contributing effort along this line.

Propaganda Needed

In so far as the electrical industry is concerned the writer feels that propaganda should be initiated over the signature of the Associated Manufacturers of Electrical Supplies as an organization to build public confidence that further price advances need not be feared and to impress upon manufacturers that every effort will be made to stabilize prices and that no orders will be accepted subject to cancellation.

Customers should be notified and articles should appear in the various trade journals advising buyers of electrical material that cancellations should not and will not be accepted by electrical manufacturers, as was the case in 1920, without proper indemnity against loss. This should include depreciation in the price of materials on hand or in process of manufacture and yet undelivered which have been purchased in good faith by manufacturers against orders on hand.

If this vicious circle of advance is permitted to go ahead unchecked, there can be only one result, a smash-up with a period of depression following. Surely, therefore, it is worth while making every possible effort to prevent it, and I believe that if propaganda along the general lines suggested above could be "put across" to every dealer, wholesaler and retailer alike, it would be

an exceedingly wholesome thing. The consumer would understand clearly, when a purchase was made, that the goods would have to be taken, the dealer in buying from his jobber would clearly understand the same thing, as would also the jobber with respect to purchases made from the manufacturer. In a nutshell the whole thought in the matter is simply this, that if manufacturers are to be saved from tremendous losses, in the event of another depression, it should be guarded against now by organized propaganda, which should be steadily supported by all manufacturers until the danger mark has been passed.

Who Should Pay the Cost of Improvement?

A Discussion of the Question Whether Code Changes Should Be Postponed to Suit the Convenience of the Manufacturer

BY KASSANDRA

WHENEVER an improvement or an invention is made there are two sets of costs involved. The first and most obvious is the labor of the inventor and of the people who develop the improvement and put it in use. These costs, of course, are paid by the people who use the improvement. It would not be an improvement unless it could be sold at a price such as to pay these costs, or rather no one would work to make an improvement unless he anticipated that he could collect his costs from the user and that the latter would most willingly pay them out of the savings effected as compared with the old methods.

In addition to these obvious costs of making an improvement, there is another set of costs—those involved in scrapping the goods or material made under the old methods. When railroads were introduced stage-coaches became of less value. When turbines came into use the value of reciprocating engines decreased. When cloth came to be spun and woven by machinery the skill of the old hand workers did not earn the wages for them that it had formerly earned. These costs of an improvement are like growing pains. The community suffers from them, but it does not want to sit still and make no advance merely because improvements involve costs which in the beginning are an evil.

Now, there are two ways to handle these costs of the second class. One is the normal and ordinary way. Every one when building a machine or acquiring a trade understands that there is a certain risk, that the machine may become antiquated before it is worn out, and that it may even become antiquated before it is put into service. This is the ordinary risk of business just as if a man buys an automobile for a given price and later the manufacturer cuts that price. The man who bought some time ago at the higher price does not expect to be able to sell out at a price based on what he paid. He can sell only at a price based on the market.

If a man builds an office building when the prices of building material are high, and then later a competing office building is put up at low prices, the rents will be the same irrespective of the original cost. This is the normal and ordinary course in case of any change or improvement.

PROGRESS NOT TO BE POSTPONED

Now, however, it is being suggested that in the case of certain changes and improvements—namely, those in the National Electrical Code—those who have stocks on hand should not only be allowed to dispose of these as they see fit, but, further, that no one should be allowed to use the improvements until the old and inferior stocks have been sold off without any competition from material conforming with the better methods. This would almost correspond to a suggestion that nobody should have been allowed to ride in railroads until the stage coaches had worn out.

The idea that the use of an improvement must be postponed merely for the benefit of the people who have made goods or have acquired skill under the old methods would seem to be a very dangerous one to put into effect. To do so would seem to put an entirely unfair burden on the user, who would like to use the improvement as soon as it is made. Why should he be asked to pay for all this cost, when the user who is willing to postpone buying for a few months is to have the full benefit of the improvement contemplated?

The municipal and other inspectors who pass on safety should not go outside of their province to determine who should and who should not pay the cost of improvements. Their province is merely the province of safety. The payment of costs should be left to the normal and natural course of business.

Further Waste Inexcusable

Experience Plus Jobbers' Cost Study Proves Importance of Discarding Excess Lines

BY W. E. ROBERTSON
Robertson Cataract Electric Company, Buffalo, N. Y.

THE avenue of hope to realize a reasonable return on the investment in our branch of the industry lies in close analytical study of the possibility of reducing the excess varieties of stock now manufactured and carried. More real progress toward better conditions is to be found in that way than in any other single thing we can do.

The creation of demand for special shapes and sizes of articles that vary but slightly from generally accepted standards and the stocking of these articles, while questionable in the past, will be an inexcusable waste if continued in the future, now that we are realizing what it is costing the industry and the insignificant value of the service thus rendered. We have made one of the most exhaustive studies of this question that has ever been made in the history of the jobbing industry, and while this study was carried on in 1921 at the expense of the jobbers' association, it has been continued, for comparative purposes, at our own expense during 1922. We intend to give the benefit of these studies, and our conclusions, to the trade, and we intend as a matter of practice, so far as our company is concerned, either to eliminate from our stock the articles that are substantial duplicates of standard articles, and also to eliminate articles that are likely to become obsolete in a short time, or else to charge enough for articles of this kind to repay us amply for having them on our shelves to serve the occasional demand.

If we can neither eliminate nor get a satisfactory price for the articles we sell, we will eliminate the line in its entirety and confine our efforts to those things that will yield a profit, even if it takes us as far afield as the sale of spaghetti or shoestrings. We are not in business for our health, but to make a net profit on the investment intrusted to us, and we do not intend to ruin our health fighting impossible conditions, once we understand the facts.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

ORDERS to manufacturers are in more wholesome volume than three weeks ago, say several leading authorities, and general business of the industry has a more favorable outlook for the coming summer months than was the case a year ago. Business in small motors, appliances and wiring devices is much improved throughout the country. Lamp sales at the present time are known to be enormous.

Sales of transmission material are reported as only fair, owing to a lull started in the line extensions by utilities three weeks ago. Stocks of poles are plentiful in all parts of the country.

Wire and rigid conduit stocks are much improved, and there is little trouble being experienced in filling orders.

The fixture, radio, signal apparatus and transformer markets have shown a slight falling off during the past week.

General Business Horizon Becomes Brighter

THE past week has brought about a change in sentiment in many lines of industries, and "more disposition has been shown in different quarters this week to stress the favorable aspects of the business situation," according to *Dun's Review*. "While commercial activities have lately abated, both production and consumption of goods continue to be of large volume in the aggregate," add the paper, "and the fact that speculative excesses are still being discouraged is considered reassuring.

"The prevailing policy now, as it has been for a long time past, is one of conservatism, and there has been plain evidence that the heavy transactions of recent months have been based mainly on actual requirements. Despite reports of some cancellations of contracts, no indication exists that this condition has developed generally, the bulk of the merchandise ordered being taken promptly by most purchasers. Returns of car loadings testify each week to the remarkable magnitude of the freight movement on the railroads, new maximums for the season being regularly established, and various other statistical measures show that operations remain on an active scale in many instances. With many needs already provided for, however, some contraction of new demand at present is not unnatural, and the approach of summer usually is accompanied by a slackening of work both in mercantile and industrial channels.

"In the building field, as at certain manufacturing centers, labor troubles have begun to impose restraint on progress and to restrict the public buying power. The backward weather, moreover, has prevented a full development of retail trade and signs of price concessions at the counters have not been lacking."

Well-Sustained Demand for Control Apparatus in Varied Fields

ALTHOUGH inquiries for control apparatus have diminished slightly as compared with the peak business of March, manufacturers of this class of equipment are extremely busy filling orders and are receiving a very healthy volume of new trade. In the rubber-manufacturing industry business has been particularly good for control makers, and the printing industry has bulked large in recent requisitions. Late developments along the line of providing automatic control for certain processes in series in textile production have brought an increasing business to producers of electrical control equipment.

A revival of purchasing in the industrial electric truck, tractor and electric road-truck fields has led to the placing of numerous orders for charging panels and auxiliary apparatus, some of these running into scores of units. At the factories raw materials are being kept well in line with demands, labor is well employed and none too plentiful, and deliveries are keeping well ahead of motor shipments except where delays occur through the failure of buyers or their engineers to furnish the control-equipment maker with complete field data. Prices of control equipment now seem steady after a recent advance of 10 per cent in accord with the upward swing in motor prices.

Conditions in Eastern Section Show Little Change

CONDITIONS in the Eastern section show little change in the electrical field during the past week, barring a tendency toward a reduced volume of business which is enabling jobbers and manufacturers to catch up somewhat on deliveries and to replenish low stocks. In most lines stocks are now in excellent volume and sizes are well assorted. Some difficulty is still reported in getting porcelain into this territory.

Recent shortages in rigid conduit are for the time being a thing of the past, and some jobbers are so well stocked that they are buying very conservatively. Less and less danger of inflation appears to be evident, and, on the other hand, opinions favor a continuance of good business for many months.

In the telephone field new construction is extremely active, and central-station extensions continue at a good pace. Labor troubles in the leather industry are causing some disquiet in this district, and some uncertainty surrounds the telephone labor situation, in view of the refusal of a New England company to grant increased wages and a seven-hour day at its operators' recent demand.

Machinery agents are handling an excellent volume of business; the electrical appliance trade is very active for this season, and house wiring is being done on a large scale.

Wider Use of Electricity Is Shown in Japan

PROGRESS of electrification in business, industry and home in the Orient seems to be directly dependent upon the stability of government and the faith in the government that big business interests have, according to C. G. Schluederberg of the Westinghouse Electric & Manufacturing Company, who has just returned from a six months' business survey of the Far East in the interests of the merchandising, supply and industrial departments of his company.

Japan is highly electrified and from the survey made by Mr. Schluederberg is rapidly approaching the highly specialized use of electricity to which Americans are now accustomed. The country is very widely covered with a network of high-tension lines that extend from city to city and thus afford the Japanese opportunity for all applications of electricity.

In home life especially is the Japanese beginning to find wider use for electricity. The average Japanese in absorbing Western civilization is finding an increasing dislike for cold houses, and as the houses are of wood lightly constructed, and the doors, windows and walls are only framework, covered with paper in many cases, they are exceedingly cold in winter if no artificial heating method is installed. Formerly the only heating appliance the natives had was a sort of charcoal stove on which the meals were cooked and a few small portable crocks or braziers called "hibachis" in which a little charcoal glowed. These are beginning to disappear and electric heaters and cooking appliances are taking their places.

Another reason for the rapid conversion of Japanese to electrical domestic appliances is the increase in wages demanded by the workers and household servants. For this reason the electric washer, ironer, heating appliances such as irons, hotplates, table stoves, etc., and fans have taken the place of many picturesque servants.

So completely are the cities wired that even the street peddlers, somewhat on the order of our own, except that they have stands along certain streets during the evening hours, have electric lights hanging in front of their carts or above their wares as spread along the edge of the sidewalk.

Street lighting is a problem that Japan will have to deal with just as has

America. Her street lighting in the larger cities is only fairly well taken care of. Although there are none of the great white ways of the many American metropolises, Japanese cities have well-illuminated business streets, largely on account of the store fronts, which, brilliantly lighted at night, add materially to the street-lighting installations, and as it is customary for the Japanese stores to remain open quite late the business thoroughfares at least compare favorably in illumination with those of America.

Appliances Are Quite Slow in Pacific Coast Territory

MAY construction in the Pacific Coast territory was very brisk. Monthly building totals all through California exceed the corresponding 1922 totals by 20 per cent to 50 per cent. Electrical stocks are lower than for several months. Rail freight rates are expected to drop soon, a recent conduit carload rate drop of about 10 per cent being taken as fairly indicative.

Appliance business is quite slow except for the extraordinary call for household irons. Radio business has decreased in volume but is being satisfactorily renovated for an encouraging future. The wire market is unsteady, rubber-covered having fluctuated from a 5 per cent advance to a 10 per cent drop in certain sizes and lamp cord and weatherproof having dropped rather sharply.

Tape Market Active with Unsettled Prices

FULL-TIME factory operation, cautious buying by jobbers and considerable uncertainty in price movements characterize the friction tape market at present. In manufacturing circles it is reported that up to Jan. 1 orders were being received at a rate which was breaking all records, and production by strenuous exertions only was keeping pace with demand.

The large volume of business being handled attracted new producers into the field, and in the trade it is a frequent topic of discussion how these later entrants can conduct a successful business on the basis of price cuts which the older manufacturers have been encountering. In one instance a manufacturer quoted on tape on a basis of sheeting costs around 9 cents per unit, whereas this raw material was then actually upon a 14-cent cost basis. When the discrepancy was called to his attention surprise was expressed and some recognition given to the importance of more accurate factory accounting and a closer co-ordination between the production and sales functions of the concern. During the past week both rubber and sheeting have fallen off slightly in price, and this has been reflected in immediate inquiries of the manufacturers from large purchasing agents as to the possibility of corresponding reductions in tape quotations. Incidentally, labor has just been advanced about 10 per cent in wages.

In manufacturing quarters there is a widespread desire for price stabilization. Well-informed opinion is to the effect that rigid prices are undesirable in the face of fluctuating costs, both fixed and operating, but representative sales managers feel that purchasers should take more account of the time interval between raw-material price changes and the utilization of such material in the factory, and that a reasonable allowance should be given to the accumulation of stocks of raw material at high prices in order to render good service to the industry. If cotton drops on the exchange, some purchasing agents at once expect reductions in tape quotations, not realizing apparently that the tape manufacturer cannot immediately begin to fabricate his product with the lower cost raw material. Prices are responsive in time to these changes in basic commodity quotations. Perhaps even more important is the question of recognizing quality in purchasing material of the tape class. The idea is that "tape is tape" still persists among buyers, and both laboratory and service tests discount this view as most inaccurate and deserving of modification in practice.

Eastern Manufacturer Comments on Western Co-operation

"THE wonderful spirit of co-operation among electrical men is the thing that has impressed me most on my Western business trip," said J. H. Parker, porcelain manufacturer of Parkesburg, Pa., to a representative of the ELECTRICAL WORLD, while in San Francisco recently. "Not only is this spirit evident at the various gatherings of electrical men which I have attended, but I find that the men carry it with them to their offices and manifest it in their business relations with each other. I cannot help being impressed with the building activity and the hydro-electric development that one sees on every hand in all parts of the West."

Commenting on the present upward trend of prices, Mr. Parker said: "Eastern manufacturers are making a concerted effort to forestall another period of inflation by suspending all buying for a period of ninety days. If manufacturers will avoid raising prices more than just enough to cover the increase in cost of raw materials and labor and the buyer will assist in preventing the pyramiding of orders, we shall come out of the present situation without any serious harm."

Slowing Up of Business Reported for Chicago Market

RUMORS of impending building-trade strikes about June 1 have caused a slackening of trade. While building permits still exceed those issued last year, the same number of buildings are not being started. This would seem to indicate that conditions are not normal, a fact due to the forthcoming labor troubles. Fourteen trades were granted an increased scale of wages under the Landis award.

A few reductions of list prices in certain types of meters were announced this week. No advances were announced, and several firms are again quoting firm prices on conduit, although deliveries apparently are lengthening out. Pole-line hardware demand is up to its last week's standard. Numerous high-tension equipment sales have been made this week. The demand for radio material is consistent with this time of the year. One firm announced a reduction of list prices on several of its larger units. Hollow-ware sales are keeping up; buying is normal.

The Metal Market

COPPER ended the week about one-quarter of a cent under the previous week's close. Producers were openly naming 15.37½ cents delivered, and buyers were confident they could obtain the metal at 15.25 cents delivered, but at the same time were not anxious to try. Some producers are not naming under 15.50 cents, which is equivalent to being out of the market.

The official contract price of the American Smelting & Refining Company continues at 7.25 cents, New York. The new level of price seems to be satisfactory to producer and consumer alike, and there is no immediate likelihood of a change unless something unforeseen happens in London. Prices there are about on a New York parity, making an allowance for freight and duty. Sales have been made in much better volume during the last week, mostly for June and early July delivery at the 7.25-cent level.

NEW YORK METAL MARKET PRICES

	May 23, 1923 Cents per Pound	May 29, 1923 Cents per Pound
Copper, Electrolytic	15.75	15.25
Lead, Am.S.& R.price	7.25	7.25
Antimony	8.00	8.00
Nickel, ingot	28.00 to 30.00	28.00 to 31.00
Zinc, spot	6.60	6.60
Tin, Straits	43.00	43.00
Aluminum, 98 to 99 per cent	26.00 to 27.00	26.00

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.034	$0.0326	$0.0236
Cold finished shafting, per lb.	0.042	0.0406	0.032
Brass rods, per lb.	0.1850	0.1913	0.1466
Solder (half and half), per lb.	0.2862	0.30	0.21
Cotton waste, per lb.	0.1231	0.1231	0.104
Washers, cast iron (⅜-in.), per 100 lb.	4.66	4.66	4.00
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	2.96	2.96	3.1[illegible]
Machine oil, per gal.	0.349	0.349	0.40
Belting, leather, medium, off list	42%	42%	48½%
Machine bolts, up to 1-in. x 30-in., off list	44½%	44½%	62½%

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Allis-Chalmers Unfilled Orders

The Allis-Chalmers Manufacturing Company, Milwaukee, reports that orders were slower in all departments during May, in line with what officials state is a trade decline for the products they manufacture throughout the market. The company gained $1,000,000 in unfilled orders on May 1, with a total of $12,590,000, compared with $11,570,000 on April 1.

The company had averaged a net gain in unfilled orders of $1,000,000 a month in 1923 up to May 1, but this ratio is not expected to be maintained on June 1. The company is still taking on additional employees to cope with the large increase in orders during the first four months of the year.

Surgical Instrument Maker Enters Electric Tool Line

The Bard-Parker Company, 37 East Twenty-eighth Street, New York City, manufacturer of surgical knives with detachable blades, has entered the electrical market with a recently perfected wire insulation-stripper. The basic patent for this tool was bought from the Wood interests, manufacturers of the "Wood stripper."

Production facilities at the company's plant at 150 Lafayette Street, New York City, allows for 4,000 insulation strippers monthly, which production is being maintained in order to fill orders already received. The company plans to enlarge its line with other tools for the electrical industry. Morgan Parker is president and Charles R. Bard is secretary and treasurer.

Wetmore-Savage New Additions Will Soon Be Completed

The Wetmore-Savage Company, electrical jobber, 74 Pearl Street, Boston, will soon complete alterations to its recently acquired building next to it on Pearl Street. When alterations to the new and old quarters are finished, its salesroom space will be doubled and considerable space will be added to the general offices and shipping room.

Westinghouse Homewood Plant Was Opened Last Week

With an inspection by executives and managers of the company, the new renewal-parts plant of the Westinghouse Electric & Manufacturing Company, Homewood, Pittsburgh, was formally opened last week.

The plant, which will begin operations immediately, fills a long-felt need for such an activity in this district and it constitutes an addition to the already broad service program of the Westinghouse company. The new works, with other additions to be erected in the future as they are needed, will specialize in the manufacture of renewal parts for motors and other apparatus already in service but which have become non-current and obsolete.

The new building, situated near the Homewood station of the Pennsylvania Railroad and connected to that railroad by a siding running into the building, is of brick, cement and steel, 202 ft. long and 102 ft. in width. It is built on a plot of three acres, providing ample space for future expansion.

The management of the new plant is headed by E. C. Brandt, a Westinghouse employee for eighteen years. Mr. Brandt came to the Homewood plant from Brooklyn, N. Y., where he directed the operation of the Krantz Manufacturing Company, which was combined by the Westinghouse Electric Company under the name of the Electric Products Company of Mansfield, Ohio. W. C. Henderson, formerly general foreman of the railway department at the East Pittsburgh main works of the Westinghouse Company, is superintendent. F. F. Rohrer will direct the sales activity, and A. L. Broomall will be renewal-parts engineer.

Orders "Simplex" Suit Tried in U. S. District Court

The suit of the American Steel Foundries against Thomas E. Robertson, commissioner of patents, and the Simplex Electric Heating Company, to compel registration of the trademark "Simplex" will be tried by the United States District Court. Suit was filed in the District Court for Northern Illinois. The court dismissed the bill on the ground of lack of jurisdiction. The Supreme Court on May 21 declared that the dismissal was erroneous and that the law regarding trademarks is not the same as that governing patents.

Wagner Electric Company Loses in Supreme Court

The Wagner Electric Company lost in its efforts to resist payment of a judgment of Lamar Lynden for royalties on a patent when the United States Supreme Court on May 21 affirmed the decision of the lower courts dismissing the company's suit against Lynden and the sheriff of St. Louis. Lynden sued, won a judgment, and an execution was issued for the $12,029 ordered by the jury. The company paid, then sued to prevent the sheriff turning the money over to Lynden and recover it.

General Electric Receives Large Sawmill Orders

The General Electric Company has received an order for the complete electrical equipment of the power plant of an immense sawmill being built by the Long Bell Lumber Company at Longview, Wash. The mill will have a steam-electric power plant of 20,000 kw. capacity.

The equipment which has been ordered includes three 6,000-kw. generators and turbines, a 200-kw. motor-generator exciter set, a 200-kw. turbine-exciter set, two 300-kw. direct-current motor-generator sets, two 25-kw. battery-charging motor-generator sets, power-house local supply and lighting transformers and complete switchboard.

The Oregon-American Lumber Company at Veronia, Ore., has placed an order for one 2,000-kw., one 1,000-kw. and one 100-kw. turbine and generator, as well as for complete switchboard and all mill motors.

Duncan Electric Appointments

The Duncan Electric Manufacturing Company, manufacturer of meters and transformers, Lafayette, Ind., announces the appointment of the following district sales agents:

The Power Machinery Company, 601 Dwight Building, Kansas City, L. H. Keller, president, A. G. Miller, secretary, for Missouri, Kansas and Oklahoma. A. F. Krippner, 905 Fourteenth Street, Denver, for Colorado, Wyoming and New Mexico. E. H. Albrecht & Company, 309 Lewis Building, Portland, Ore., for Oregon and Washington. Wallene Engineering Company, 511 Hippodrome Building, Cleveland, for northern Ohio. J. Harry Burroughs, 106 Macamley Street, Buffalo, for the State of New York exclusive of New York City. J. W. Murphy Company, 108 S. LaSalle Street, Chicago, for Chicago and Cook County, Ill.

Porphyry Copper Earnings Show Improvement

The report of the Utah Copper Company for the first quarter of the current year shows total income of $2,241,111, equivalent to $1.37 a share (par $10) on $16,244,900 capital stock, against $1,740,249, or $1.07 a share in the preceding quarter. Operating profit was $1,797,521, against $1,346,287, and the surplus after dividends, $616,621, against $928,004.

The first quarter output of Utah amounted to 33,103,190 lb. of marketable copper, against 31,495,654 lb. in the last quarter of last year, according to D. C. Jackling, president of the company. The cost of production was 8.825 cents a pound, including all fixed and general charges, except depreciation and federal tax reserves.

The Nevada Consolidated Copper Company reported for the first quarter a total income of $544,222, equivalent to 27 cents a share (par $5) on the $9,097,285 capital stock, as against

$417,082, or 20 cents a share, in the preceding quarter. Operating profit was $446,929, against a loss of $164,764 for the last quarter of last year. In commenting on the result of operation of this company, Mr. Jackling notes that production amounted to 11,780,815 lb. of copper, against 7,448,465 lb. the previous quarter.

The Ray Consolidated Copper Company for the first three months of 1923 showed a total income of $488,425, equivalent to 31 cents a share on the $15,771,790 (par $10) capital stock, against $201,903, or 12 cents a share, for the previous quarter. Operating profit was $458,988, against $165,538, and other income $29,436, against $36,365. In his remarks to stockholders, Sherwood Aldrich, president, points out that production for the first three months of the current year amounted to 14,009,441 lb. of net copper, against 12,249,695 lb. in the preceding three months.

Guth Lighting Fixture Firm in Million-Dollar Organization

The Edwin F. Guth Company, manufacturer of lighting equipment, is the new name by which the unified interests of the St. Louis Brass Manufacturing Company and the Brascolite Company, St. Louis, will hereafter be known. The two companies amalgamated have always been interrelated. The Brascolite Company was a division of the St. Louis Brass Manufacturing Company. The St. Louis Brass Manufacturing Company, the parent company, was incorporated in 1902 by Edwin F. Guth and associates for the manufacture of lighting fixtures of all types.

Complaint About Hygrade Lamp from Federal Trade Commission

The Federal Trade Commission has issued a complaint against the Hygrade Lamp Company, Salem, Mass. The respondent is charged with acquiring the capital stock of the Lux Manufacturing Company, a competing concern, and has therefore gained control and management of such competing company. This, the commission alleges, has the effect of substantially lessenging competition heretofore existing between the two companies.

Further allegations are to the effect that the respondent adopted and enforced a policy of requiring each and every jobber purchasing its lamps to enter into an exclusive agreement whereby such jobber agrees to purchase its entire requirements of electric lamps for a period of one year from the respondent and not to offer for sale, quote or sell Hygrade lamps to customers outside of the jobber's exclusive territory, which is clearly defined in the agreement, the respondent agreeing to sell exclusively to the jobber in his exclusive territory.

The respondent's acts, the commission alleges, have a tendency to deprive the general purchasing public of the benefits of free competition in the products which are handled by the respondent. Thirty days will elapse in which the respondent may make answer to the charges before a day is set for further hearing before the Federal Trade Commission.

Eureka Cleaner Sales Meeting

A. S. McCarthy, vice-president and general sales manager of the Eureka Vacuum Cleaner Company, Detroit, visited Spokane May 11 and was the guest of honor at a banquet held the same evening. Fifty of the Eureka sales staff in Washington, Idaho and Montana were present.

"We will sell 200,000 cleaners in 1923," said Mr. McCarthy. "This may seem like a large statement until you hear that we sold 150,000 in 1922 and that the buying power is greater this year than last. I found prosperity in every city visited on this tour. Two-thirds of the districts have made sales that are ahead of their quota in number."

Mr. McCarthy's address was followed by the display of half a mile of film showing the manufacture of Eureka cleaners. Stress was laid on the point that every part of this machine is made in the company's plant.

The Wireless Resistor Company, Milwaukee, has been organized by Arnold Pfau, 3011 McKinley Boulevard, consulting engineer of the Allis-Chalmers Manufacturing Company, to engage in the manufacture of a new metal alloy under exclusive American rights to Swiss patents. J. Rohn and Arthur Voss are associated with Mr. Pfau. A factory is being equipped in Milwaukee and it is planned to start production of bars by June 1.

The Arnold Electric Drill Company, New Haven, Conn., recently incorporated under the laws of that state, will engage in the manufacture and sale of electric drills, electric tools and appliances, and will have a factory in that city. The capital stock is $50,000 and the incorporators include Frederick E. Levere, 658 Campbell Avenue, West Haven, Conn.; E. O. Levere and H. A. Walzenberger of New Haven.

The National Light & Electric Company, 291 Market Street, Newark, N. J., radio equipment and electrical specialties, has acquired the four-story building at 57-59 Lafayette Street for a new plant and headquarters. The company will occupy the entire building, totaling about 20,000 sq.ft. of space. George Allendorf is president and Harry Hirsch, treasurer.

The Packard Electric Company, Ltd., St. Catharines, Ont., manufacturer of electric apparatus, announces the appointment of Andrew S. Tait as district sales manager with headquarters in Montreal. Mr. Tait was formerly chief electrical engineer of the Canadian Car & Foundry Company and its subsidiaries and prior to that time with the Canadian General Electric Company as district engineer during a period of thirteen years.

The Glow Electric Company, Cincinnati, manufacturer of portable electric tools and motors, will shortly commence the erection of a factory at Second Street. It will be one story, of concrete construction, with provision for additional floors later.

The Edison Storage Battery Company, West Orange, N. J., has preliminary plans under consideration for the construction of a new plant on a site adjoining the factory of the Ford Motor Company, now in course of erection on Green Island, near Troy, N. Y. Power from the hydro-electric generating plant of the Ford company now being built will be used at the proposed works, which will be used for a certain branch of battery production. It is expected to commence work late this year or early in 1924. The plant will give employment to about 300 operatives.

The Luminier Company, 577 Broadway, New York City, has been incorporated with capital stock of $50,000 to manufacture electric fixtures and equipment. The incorporators are J. Schiller, L. A. Schoen and L. L. Lazaroe.

E. T. Cunningham, Inc., San Francisco, recently incorporated with capital stock of $200,000, will manufacture electrical equipment. The company acquires business and assets of a firm which has been engaged in electrical manufacturing for some time. E. T. Cunningham, 248 first Street, San Francisco, is president.

The Conveyors' Corporation of America, 326 West Madison Street, Chicago, has appointed the Pittsburgh Machine Products Company, Oliver Building, Pittsburgh, as district representative. It is also announced that S. L. Wright & Company, district representatives of the Conveyors' Corporation in Butte, Mont., have moved their offices from 109 East Broadway to 812 East Iron Street.

The Overflow Alarm Corporation, Brooklyn, N. Y., recently organized with capital stock of $100,000, will manufacture electric alarm devices. The company is looking for a plant somewhere in the vicinity of New York. Plans for manufacturing are as yet undetermined. The incorporators are J. E. Tobin, H. Gessler and T. Wolkind. The present address is 51 Chambers Street, New York City.

The Connecticut Telephone & Electric Company, Meriden, Conn., has purchased the former plant of the Wilcox & White Company, makers of Angelus player pianos. This new addition will be known as Plant No. 2 and is located but a short distance from the Connecticut company's plant No. 1. The new plant is a four-story modern brick structure built in the form of a hollow square with power house in the center and contains approximately 125,000 sq. ft. of floor space. It will be used for the general expansion of business.

Foreign Trade Opportunities

ARAPUNI (NEW ZEALAND) ELECTRIC POWER SCHEME.—Tenders will be received by the secretary of the Public Works Tender Board, Wellington, New Zealand, until Feb. 28, 1924, for section 1, headworks, of the Arapuni electric power scheme. Specifications may be seen on application at the New York, Cleveland, Chicago and San Francisco offices of the ELECTRICAL WORLD.

HYDRO-ELECTRIC PROJECT NEAR SAO PAULO, BRAZIL.—Application has been made by the Sociedad Anonyma Brasital, according to *Commerce Reports*, for permission to build a hydro-electric plant on the Tiete River near the falls of Ittu, a short distance from São Paulo. A concession covering this same project was obtained by the company in 1911.

POWER DEVELOPMENT FOR IRISH FREE STATE.—A company has been formed under the name of the Inner Liffey Power Development Company, Ltd., to supply electricity for lamps and motors. It is proposed that the Free State government should guarantee the financing and take over the operation of the system when completed, either for itself or in collaboration with the corporation of the city of Dublin. The promoters, however, are willing to carry out the entire scheme and are endeavoring to secure a license under Article II of the constitution.

PROPOSED ELECTRIC POWER SCHEME FOR IRELAND. — Plans are progressing, *Commerce Reports* states, for utilizing the water power of the Bann River flowing into Lough Neagh, in County Antrim, Ireland, about 30 miles from Belfast, for the purpose of supplying electricity for all industries in that section. Early this year a bill was introduced into the Imperial Parliament for the chartering of a company and conferring upon it the necessary powers to proceed with the project.

PROPOSED HYDRO-ELECTRIC PLANT IN RIO GRANDE DO SUL.—Plans have been approved to utilize the Toca Falls of the Santa Cruz River in the State of Rio Grand do Sul, Brazil, according to *Commerce Reports*, to supply electricity for light and power for a number of municipalities in São Leopoldo and Taquary. A 40,000-volt transmission line, 79 km. long, will be erected. The cost of the project is estimated at 2,000,000 milreis.

New Apparatus and Publications

ENGINE-DRIVEN ALTERNATORS. — Leaflet No. 2,390-A issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes and illustrates the construction of its type "E" engine-driven alternating-current generators rated at from 50 kva. to 3,000 kva.

TEMPERATURE INDICATOR. — The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing leaflet No. 3,477-A, which covers its "Hot-Spot" temperature indicator for transformers.

HOT PLATE. — The Rogers Electric Laboratories Company, Cleveland, has placed on the market a new model hot plate, known as the "Rogers-Quality."

SHOW-WINDOW LAMP. — The Pittsburgh Reflector & Illuminating Company, Bowman Building, Pittsburgh, Pa., is distributing a folder describing the "Pittsburgh" show window "Flood-O-Lite" with center spot for spot lighting and for color lighting.

TEST SET.—The Western Electro-Mechanical Company, Inc., Oakland, Cal., has developed an alternating-current test set in conjunction with an alternating-current ammeter.

ELECTRIC VACUUM CLEANER. — A new electric vacuum cleaner, "Bissle Home," has been placed on the market by the Bissell Motor Company, Toledo, Ohio.

COMMERCIAL LIGHTING UNIT. — A line of lighting units known as "Cora-Lites" has been brought out by the Consolidated Lamp & Glass Company, Coraopolis, Pa.

PORTABLE MOTOR UNIT.—The Champion Appliance Manufacturing Company, Inc., 44 Main Street, Yonkers, N. Y., has placed on the market its "Champco Service Unit," a portable ball-bearing motor mounted on a movable pedestal, which can be adjusted so as to operate various household appliances.

PORTABLE TEST METER.—The Sangamo Electric Company, Springfield, Ill., has placed on the market its "HP-6" alternating-current portable test meter.

ELECTRIC FURNACE TENDER.—The Domestic Stoker Company, Paterson, N. J., has developed an electrically driven machine which enables buckwheat coal and anthracite coaldust to be burned in the ordinary household furnace and which automatically feeds the fuel into the furnace and at the same time withdraws the ashes and deposits them in an outside bin.

WASTE-HEAT BOILER PLANT. — The Heine Boiler Company, St. Louis, is distributing a booklet which describes and illustrates the waste-heat boiler plant of the Cape Girardeau Portland Cement Company, in which "Heine" boilers are used.

INDOOR BUS SUPPORTS.—Schweitzer & Conrad, Inc., 4435 Ravenswood Avenue, Chicago, are distributing bulletin No. 223 covering their type C indoor bus supports.

WATT-HOUR METERS.—The Sangamo Electric Company, Springfield, Ill., has issued bulletin No. 61, giving instructions for the "Sangamo" type-H single and polyphase watt-hour meters.

ELECTRICAL SUPPLIES. — The Mid-West Electric Company, Omaha, Neb., has revised its monthly publication, *Cost Finder*, which contains a list of products carried by the company.

STREET-LIGHTING FIXTURES. — The Mid-West Electric Company, Omaha, Neb., is distributing its street-lighting bulletin which describes and illustrates different types of ornamental lighting fixtures.

New Incorporations

THE PIGEON RIVER POWER COMPANY, Waynesville, N. C., has been incorporated with a capital stock of $50,000 to construct a hydro-electric plant on the Pigeon River. The incorporators are Feliz E. Alley, Jr., D. L. Boyd and Feliz S. Alley.

THE WILLIAMSBURGH POWER PLANT CORPORATION, Brooklyn, N. Y., has been incorporated by S. Clerke, J. V. Cline and O. Everett. F. J. Knorr, Albany, is attorney.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

WORCESTER, MASS.—The New England Power Company has petitioned the Department of Public Utilities for permission to erect a 110,000-volt transmission line from Adams, Mass., to North Albany, N. Y., connnecting with the substation of the Adirondack Power & Light Corporation at that point. The cost in Massachusetts is estimated at $250,000.

MONTVILLE, CONN.—The Eastern Connecticut Power Company has sold $1,500,000 in stock, the proceeds to be used for the construction of an addition to its local steam-driven electric plant and for the acquisition of other electrical properties.

NEW BRITAIN, CONN.—The P. & F. Corbin Company, a division of the American Hardware Corporation, will build an addition to its power plant, to cost about $30,000.

WINSTED, CONN.—The Riverton Paper Company will install electric power equipment and other machinery at its mill.

Middle Atlantic States

MEDINA, N. Y.—The Western New York Utilities, Inc., has issued $560,000 in capital stock, part of the proceeds to be used for extensions and improvements.

NEW YORK, N. Y.—Bids will be received by the superintendent of lighthouses, Staten Island, until June 18, for 375 dry cells, 2½ in.x6 in. (Circular 14,866.)

NEW YORK, N. Y.—The New York Edison Company has completed plans for a substation at 49-51 Park Place, to cost $140,000.

NEW YORK, N. Y.—Electric power equipment will be installed in the proposed ice and refrigerating plant to be erected on Washington Street by the Fox-Goldberg Holding Corporation, 350 Broadway, to cost about $150,000. Robert S. Kaplan, 56 West 115th Street, is architect.

POTSDAM, N. Y. — Electric pumping equipment will be installed in connection with the proposed new municipal water system.

WATERTOWN, N. Y.—The Power Corporation of New York, Northern New York Trust Building, has issued $1,000,000 in bonds, the proceeds to be used for the construction of a 6,500-hp. hydro-electric station at Herrings, and to complete the generating plant now in course of erection at Norwood.

NEWARK, N. J.—The Public Service Electric Company plans to build a substation on West Street, Bloomfield. Extensions and improvements will also be made in the mechanical shop and pumping plant, foot of Duffield Street, Jersey City.

BIRDSBORO, PA.—The Birdsboro Stone Company, plans to rebuild its power house and crushing plant recently destroyed by fire, causing a loss of about $250,000.

CHAMBERSBURG, PA.—The Weitzel Lumber Company, Germantown Avenue, Philadelphia, plans to install elecrtic power equipment at its local mill, recently acquired from the Hollinger Planing Mill Company.

ERIE, PA.—The Mutual Telephone Company contemplates the construction of a new exchange building, to cost about $400,000.

MARCUS HOOK, PA.—The Philadelphia Electric Company is reported to have acquired a local site, on which it will erect a large power plant.

NEW OXFORD, PA.—The New Oxford Shoe Company contemplates the construction of a power house in connection with its proposed local plant to cost about $200,000.

PITTSBURGH, PA.—The Bertha-Consumers' Coal Company plans to install electric power equipment at its properties in Pennsylvania and West Virginia.

SOMERSET, MD.—Electric power and mechanical equipment will be installed in the coal-mining properties to be operated by a new company now being organized by D. B. Zimmerman, Somerset, and F. E. Rowe, Jr., Meyersdale, Pa. The new plant will cost about $150,000.

BLUEFIELD, W. VA.—The Morrow Coal Company, recently formed, contemplates the installation of electric power equipment at its local properties.

CABINCREEK, W. VA.—The Virginian Power Company plans to build an addition to its local power plant.

CHARLESTON, W. VA.—The American Gas & Electric Company, 30 Church St., New York, N. Y., has acquired the West Virginia Water & Electric Company and its subsidiaries, the Dunbar (W. Va.) Light & Power Company and the St. Albans (Va.) Power & Light Company. Plans are being considered for extensions in power plants and systems.

GILMER, W. VA.—The Quaker Coal Company contemplates the installation of electric power equipment at its properties, to develop a daily output of 500 tons.

RICHWOOD, W. VA.—Electric power equipment will be installed in the local tanning plant of the Armour Leather Company, in connection with extensions and improvements to cost about $90,000.

SHINNSTON, W. VA.—The Fairmont-West Virginia Coal Company plans to instal electric power equipment at its local properties.

CLARION, VA.—The Altavista (Va.) Light & Power Company has been granted permission to extend its line to Clarion to furnish electricity for lighting purposes.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until June 12, for one motor-generator set, one switchboard panel, 880 ft. of cable and three pothead (Schedule 863); also, until June 19, for miscellaneous quantity of flashlights and batteries (Schedule 892.)

WASHINGTON, D. C.—Bids will be received by the Chief of Air Service, United States Army, until June 5 for a quantity of single-pole, double-throw toggle switches. (Circular 23-212.)

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until June 9, for 60 radio control boxes (Proposal 14,738-2CP); also, until June 11, for 110 radio receivers and 110 radio transmitters (Circular PR 14,600-10CP).

North Central States

DETROIT, MICH.—Plans are being prepared by the Department of Street Railways for the construction of 4 miles of double-track railway line on Warren Road, East Warren and Linwood Avenues, to cost about $500,000. W. C. Markham is chief engineer.

CLEVELAND, OHIO—The Cleveland Railway Company is planning to build six automatic substations, to cost about $1,500,000. Contract has been awarded for equipment for two of the stations that are to be erected at once.

COLUMBUS, OHIO.—Bids will be received by the superintendent of purchases and printing room, room 76, State House, Columbus, Ohio, until June 5 for furnishing materials for rewiring State institutions in or near Cincinnati, Sandusky, Gallipolis, Toledo, Cleveland, Dayton, Columbus and Athens, Ohio.

ELIZABETHTOWN, KY.—The Kentucky Utilities Company, Louisville, contemplates erecting a 33,000-volt transmission line from Elizabethtown to Hardinsville, via Sonora.

LANCASTER, KY.—The Kentucky Utilities Company, Louisville, contemplates doubling the capacity of the local electric plant and to construct an ice plant, to cost about $50,000. G. T. Bogard is chief engineer.

LOUISVILLE, KY.—The Louisville Gas & Electric Company is preparing plans to construct a new power plant, to cost about $2,000,000.

INDIANAPOLIS, IND.—The Indianapolis & Cincinnati Traction Company contemplates extending its electric railway from Connersville to Cincinnati. The cost is estimated at about $1,000,000.

CHICAGO, ILL.—The Commonwealth Edison Company will build a substation on Seminary Avenue, to cost about $50,000.

GRANITE CITY, ILL.—Plans have been prepared by the Commonwealth Steel Company for extensions to its plant, including addition to power plant, pattern shop, new coke-oven building, extension to foundry, new furnace, etc. The cost is estimated at $1,000,000.

BARABOO, WIS.—The Wisconsin Power, Light & Heat Company contemplates extensions and improvements in the local plant of the McFetridge Lighting Company, recently acquired, including extensions to transmission line.

LITCHFIELD, MINN.—The City Council is considering an issue of bonds for remodeling the municipal electric light and waterworks plant.

ST. PAUL, MINN.—Contract will soon be awarded by the State Board of Control for an addition to the power plant at the Crippled Children's Home.

DUNBAR, IOWA.—The Dunbar Light & Power Company, recently organized, is planning to supply electricity in the village of Dunbar and vicinity. John Ingebritson is president.

MAQUOKETA, IOWA.—Contract has been awarded by the Hydro-Electric Company of Maquoketa for the construction of a large power dam on the Maquoketa River in connection with a large hydro-electric project. No machinery or equipment is included in the contract.

OSKALOOSA, IOWA.—The Oskaloosa Ice & Cold Storage Company plans to build a power house.

KANSAS CITY, MO.—The Ralston Purina Company, Eighth Street, plans to build a power house in connection with its plant at Scott and Rochester Streets, to cost about $1,000,000.

STOCKTON, MO.—The installation of a municipal electric light plant, to cost $20,000, is under consideration.

CROSBY, N. D.—The erection of an 13,200-volt transmission line from Crosby to Noonan is under consideration by the United Power Company.

CHANCELLOR, S. D.—Bonds to the amount of $10,000 have been issued for the installation of a municipal electric distributing system.

ARKANSAS CITY, KAN.—The Roxana Petroleum Corporation, St. Louis, plans to build a substation in connection with its proposed local refinery, to cost about $4,000,000.

BETHEL, KAN.—The Commissioners of Wyandotte County have instructed O. K. Williamson, county engineer, to prepare plans and estimates of the erection of a transmission line from Bethel to the county poor farm, a distance of about 2½ miles, to connect the poor farm with the lines of the Standard Light & Power Company. It is proposed to abandon the power plant at the institution.

EMPORIA, KAN.—The City Commission has authorized the Kansas Electric Power Company to rebuild the transmission line to the pumping station on the Neosho River. The cost is estimated at about $3,000.

OXFORD, KAN.—Plans are being prepared for the erection of a transmission line from Winfield to the Arkansas River station for local service, to cost $18,000. W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., are engineers.

WICHITA, KAN.—The Kansas Gas & Electric Company has disposed of a bond issue of $3,500,000, part of the proceeds to be used for extensions to its system.

Southern States

HIGH POINT, N. C.—The Giant Furniture Company contemplates rebuilding its power house and plant, recently destroyed by fire, with loss of about $150,000.

LEXINGTON, N. C.—The Poneemah Mills Company plans to install a substation in connection with its proposed local cotton mill, to cost about $100,000.

SANFORD, N. C.—The Virginia & Carolina Mining Company, Winston-Salem, plans to construct a power house at its new local smelting plant.

WAYNESVILLE, N. C.—Surveys are being made by the Pigeon River Power Company, recently organized, for a large hydro-electric development on the Pigeon River, between Waynesville and the Tennessee line.

GREENVILLE, S. C.—The Southern Worsted Corporation contemplates the construction of a substation in connection with a new local mill. Lockwood, Green & Company, Charlotte, N. C., are engineers.

HEATH SPRING, S. C.—Bonds to the amount of $35,000 have been voted for extensions and improvements to the electric plant and waterworks.

DAWSON, GA.—Plans are under consideration for the construction of a hydro-electric plant to supply electricity in Dawson, Shellman and Cuthbert. W. H. Locke is member of a committee appointed to look into the matter.

ROME, GA.—Plans are under consideration for the construction of a hydro-electric plant on Two Run Creek to supply electricity for the Eureka Mill, operated by Roy Wright and George Flemister.

BLOUNTSTOWN, FLA.—The Florida Orchard & Packing Company contemplates the construction of a power house at its proposed local fertilizer plant.

CANAL POINT, FLA.—The Florida Sugar & Food Products Company, Lake Worth, contemplates the installation of electric power equipment at its local mill in connection with proposed extensions and improvements to cost about $300,000.

HALE'S BAR, TENN.—Plans are being prepared by the Alabama Power Company and the Tennessee Electric Power Company for the construction of a steel-tower transmission line from Huntsville, Ala., to Hale's Bar, for interchange of service. The cost is estimated at $600,000.

BIRMINGHAM, ALA.—The Alabama Power Company has been granted permission to extend its transmission line to Childersburg, Waverly, Wetumpka, Centerville and Brent.

BIRMINGHAM, ALA.—The Alabama Power Company is preparing plans for the construction of an addition to its hydro-electric power plant, near Lock 17, on the Warrior River, to cost about $500,000.

UNION SPRINGS, ALA.—Permission has been granted the Alabama Power Company, Birmingham, to extend its transmission lines from a point near Tuskegee to Union Springs.

GREENWOOD, MISS.—The City Council has awarded a contract for the construction of a new power station for the municipal light and water plant.

LOUISVILLE, MISS.—The Council is considering calling an election to vote on the proposal to issue $30,000 in electric light bonds.

CAMDEN, ARK.—The Morris Oil Company plans to construct a substation in connection with its proposed local oil refinery, to cost about $300,000.

PINE BLUFF, ARK.—The Arkansas Light & Power Company has awarded contract to Ford, Bacon & Davis, 115 Broadway, New York City, for construction of dam and power station on the Ouachita River, near Malvern, to develop 10,000 hp. The cost is estimated at $1,250,000.

CROWLEY, LA.—Plans are under consideration for the installation of an improved fire-alarm system.

STILLWATER, OKLA.—The Council is considering the installation of electrically operated pumps in connection with a municipal waterworks system to cost about $150,000. V. V. Long & Company, Colcord Building, Oklahoma City, are engineers.

ORANGE, TEX.—The Houston, Beaumont & Orange Interurban Railway Company, organized to construct a traction line from Houston to Orange, 100 miles, plans to build a power plant and install a series of substations. S. M. White, Orange, is interested in the company.

TULSA, OKLA.—The installation of a series of electrically operated pumping plants in connection with a new pipe line from Owens Junction to Midway, a distance of 28 miles, and from Midway to Burbank Junction, 18 miles, to cost about $300,000, is under consideration by the Prairie Pipe Line Company.

FORT WORTH, TEX.—The Fort Worth Elevator Company contemplates the construction of a substation in connection with its proposed local grain elevator, to cost about $500,000.

SAN ANTONIO, TEX.—W. H. Williams and associates have acquired lignite lands in McCullen County, where they will build an electric power plant, using lignite for fuel.

YORKTOWN, TEX.—The Texas Central Power Company, San Antonio, will extend its transmission line to this place for service at Victoria, Nordheim, Nursery and Craig.

Pacific and Mountain States

SEATTLE, WASH.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 12, for electric equipment for the Puget Sound Navy Yard, including one switchboard (Schedule 881); miscellaneous quantity of electric cable (Schedule 882), and two transformers (Schedule 880).

PORTLAND, ORE.—The Grand Rapids (Mich.) Showcase Company contemplates the construction of a power house in connection with its proposed local branch plant, to cost about $500,000.

VERNONIA, ORE.—The Oregon-American Lumber Company will build an electric plant in connection with its proposed local mill, to cost about $175,000.

ALHAMBRA, CAL.—An election will be held June 5 to vote on a proposal to issue $250,000 in bonds, of which $75,000 is to be used for the installation of a new fire-alarm system and the purchase of fire apparatus.

COMPTON, CAL.—The City Council is planning to install street lamps from the northern limits of the city south to Olive Street.

EUREKA, CAL.—Electric power equipment will be installed in the proposed ice-manufacturing and cold-storage plant to be built by the Eureka Ice & Cold Storage Company, recently organized, to cost about $100,000.

FULLERTON, CAL.—Electric power equipment will be installed in the two cold-storage and precooling plants to be erected by the Placentia Orange Growers' Association at Fullerton and Placentia, to cost about $75,000 and $85,000 respectively.

LOS ANGELES, CAL.—An ordinance has been approved for the installation of an ornamental lighting system on Hollywood Boulevard from Verona Avenue to Vine Street.

LOS ANGELES, CAL.—Bonds to the amount of $808,000 have been issued for the installation of an ornamental lighting system on Belle Porte Avenue between Weston and 255th Streets.

LOS ANGELES, CAL.—The City Council has passed an ordinance authorizing the submission of a power bond issue of $25,000,000 to the voters at the general election to be held June 5. Of this amount $25,000,000 will be used for the proposed hydro-electric development at Boulder Canyon and the erection of a transmission line, and $10,000,000 for additional distribution facilities.

OAKLAND, CAL.—The Pacific Gas & Electric Company has acquired a site in the East Bay district on which it will erect a large substation.

OAKLAND, CAL.—The Victor Talking Machine Company, Camden, N. J., contemplates the construction of a power plant

JUN 14 1923

at its proposed new branch factory, to cost about $250,000. J. C. Wicks is general production manager.

PASADENA, CAL.—The City Directors have approved an ordinance calling for an issue of $730,000 in bonds, recently voted, of which $300,000 will be used for improvements to the Light and Power Department.

BOISE, IDAHO.—The Idaho Power Company has applied for permission to erect twenty-nine transmission lines, totaling 438 miles, in Idaho and Oregon, to serve sixty-seven communities along the Snake River.

CEDAR CITY, UTAH.—Tentative plans are under consideration by the Dixie Power Company for the construction of additional plants in the Pine Valley Mountains and a steam-driven plant in the coal district east of Cedar City.

RICHFIELD, UTAH.—The Royal Purple Mines Company has filed application with the state engineer for water rights to be used for the development of power.

CORTEZ, COL.—The Cortez Light & Power Company has been granted a franchise to construct and operate an electric light plant in Cortez.

WESTCLIFFE, COL.—The Custer County Electric Company, recently incorporated, is planning to construct an electric plant at Westcliffe. C. B. Beardsley is interested in the company.

Canada

FREDERICTON, N. B.—The construction of a transmission line from the Maine & New Brunswick Electric Power Company's lines near the Brunswick border to the St. John River valley as far as Woodstock is under consideration by the New Brunswick Electric Power Commission.

PORT DALHOUSIE, ONT.—The Public Utilities Commission is considering the reconstruction of the distribution system on the south side of the proposed canal.

SMITH FALLS, ONT.—The ratepayers have approved a bylaw authorizing the purchase of a power plant for use in connection with the waterworks system.

MONTREAL, QUE.—The Montreal Island Power Company, recently organized, with a capital stock of $1,375,000, proposes to build a hydro-electric plant on the Back River on the Island of Montreal to develop about 45,000 hp.

Electrical Patents

Announced by U. S. Patent Office

(Issued May 8, 1923)

1,454,474. POTENTIAL INDICATOR; O. E. Huebner, Richmond Hill, N. Y. App. filed July 5, 1921. Device to show if underground cable is alive.

1,454,493. MILL; A. Sundh, Hastings-Upon-Hudson, N. Y. App. filed Oct. 8, 1920. Instrument for indicating travel of moving part of mill.

1,454,495. SYSTEM OF CURRENT-WAVE TRANSMISSION; H. J. Vennes, New York, N. Y. App. filed May 26, 1919. Two-way transmission of modulated currents applied to telephony.

1,454,496. CALLING DEVICE; A. Vischer, Jr., Floral Park, N. Y. App. filed Dec. 21, 1920. Dial for automatic telephone system.

1,454,526. ELECTRIC BATTERY CONTROL DEVICE; W. V. Turner, Wilkinsburg, Pa. App. filed Oct. 29, 1917. Automatic device for operating storage batteries in parallel, preventing unequal discharge.

1,454,530. HANDLAMP; A. A. Arnold, Hartford, Conn. App. filed April 2, 1921. Electric flashlight.

1,454,532. METHOD OF AND MEANS FOR SECRET SIGNALING; W. E. Beatty, Bayside, N. Y. App. filed Aug. 1, 1917. Carrier wave unintelligible unless received by specially designed apparatus.

1,454,533. SUPPORT FOR TELEPHONE RECEIVERS; M. A. Bowen, Fresno, Cal. App. filed July 13, 1921. Holds receiver to ear of speaker.

1,454,566. ELECTRICAL DISPLAY DEVICE; C. E. Smith, Johnstown, Pa. App. filed Sept. 8, 1921. Successively lighting series of lamps.

1,454,567. METHOD AND APPARATUS FOR PRODUCING A CHEMICAL UNION BETWEEN HYDROCARBON GASES AND HYDROCARBON OILS; H. B. Snyder, Fullerton, Cal. App. filed Dec. 27, 1921. By electric arc.

1,454,571. STORAGE BATTERY; W. H. Thorpe, Mount Vernon, N. Y. App. filed Aug. 22, 1921. Small current output with large ampere-hour capacity.

1,454,592. WIRELESS DIRECTION-FINDING MEANS FOR AND METHOD OF PILOTING AIRCRAFT; H. R. C. Van de Velde and J. M. Furnival, Bromley, England. App. filed Jan. 7, 1921.

1,454,598. WIRELESS TRANSMITTER; W. T. Ditcham, Twickenham, England. App. filed Dec. 18, 1920. Valve transmitter for wireless telegraphy.

1,454,622. CHANGEABLE SIGN DEVICE; H. W. Cairns, Detroit, Mich. App. filed June 15, 1920. Automatic mechanism driven by motor.

1,454,623. ELECTRIC TESTING DEVICE; R. H. Carter, Cleveland, Ohio. App. filed Feb. 2, 1920. Mechanically protected test lamp in series with sharpened contact points.

1,454,624. RADIO-TELEGRAPHY SIGNALING SYSTEM; C. C. Chapman, Palo Alto, Cal. App. filed April 27, 1920. Single-wave radio signaling.

1,454,629. RADIO-TELEGRAPHY SIGNALING SYSTEM; H. F. Elliott, Palo Alto, Cal. App. filed June 6, 1921. Uniwave continuous oscillation transmission system.

1,454,630. RADIO-TELEGRAPHY; H. F. Elliott, Palo Alto, Cal. App. filed June 6, 1921. Single-wave signaling system.

1,454,634. INSULATOR; W. T. Goddard, Hamilton, Ontario, Can. App. filed Jan. 25, 1919. Construction of insulators subjected to large tensile strains.

1,454,644. ELECTRIC SPEEDOMETER; C. F. Kettering, Dayton, Ohio. App. filed Aug. 28, 1918. Magnetic type.

1,454,652. RADIO-FREQUENCY TRANSMISSION SYSTEM; H. Pratt, San Francisco, Cal. App. filed Nov. 22, 1921. Embodies Poulsen arc.

1,454,673. TROLLEY GUARD; M. Firl, Meyersdale, Pa. App. filed July 15, 1922. Prevents wheel from disengaging from wire.

1,454,706. TROLLEY-POLE SAFETY DEVICE; G. W. Dague, Oklahoma, Okla. App. filed May 12, 1922. Prevents pole from disengaging from wire.

1,454,719. FAC-SIMILE TRANSMISSION SYSTEM; H. G. Bartholomew, London, England. App. filed May 18, 1922. Photographic transmission on wires.

1,454,722. SWITCH BOX; L. Boutin, New York, N. Y. App. filed May 29, 1922. For house wiring.

1,454,736. ELECTRIC WATER STERILIZER AND PURIFIER; W. T. Harrell, Wichita, Kan. App. filed Aug. 8, 1922.

1,454,744. ELECTRIC SWITCH-HOUSE CONSTRUCTION; B. G. Jamieson, Brookfield, Ill. App. filed April 8, 1922. Complete switch-house and bus structure outlined.

1,454,768. LOCK; R. R. Raymond, New York, N. Y. App. filed May 8, 1922. For telephones to prevent unauthorized use.

1,454,773. TELEPHONE ATTACHMENT; G. W. Sumner, Dorchester, Neb. App. filed Oct. 11, 1921. For selective ringing or party line systems.

1,454,833. ELECTRICAL MACHINE; L. A. Darling, Philadelphia, Pa. App. filed April 30, 1919. Effective ventilation of armature.

(Issued May 15, 1923)

15,597 (reissue). MEASURING AND INDICATING APPARATUS; H. Brewer, Wilmette, Ill. App. filed Feb. 21, 1919. Temperature indicator.

1,454,840. MEANS FOR RINGING OVER MULTIPLEX TRANSMISSION CHANNELS; H. A. Affel, Brooklyn, N. Y. App. filed July 29, 1919.

1,454,847. SALT-BATH FURNACE; O. A. Colby, Irwin, Pa. App. filed Jan. 16, 1920. For heat-treating and tempering steel tools.

1,454,853. MOTOR-CONTROL SYSTEM; R. T. Kintzing, Wilkinsburg, Pa. App. filed July 30, 1920. For motors applied to cloth-printing apparatus.

1,454,858. CONNECTION PLUG; W. E. Price, New York, N. Y. App. filed May 12, 1920. Heavy-current stage plug.

1,454,867. MOTOR-CONTROL SYSTEM; W. R. Taliaferro, Pittsburgh, Pa. App. filed Aug. 18, 1921. For railway motors.

1,454,872. COMMUTATOR REPULSION-INDUCTION MOTOR; C. A. M. Weber, Edgewood Park, Pa. App. filed Oct. 16, 1918. Has characteristics of both repulsion and induction motor.

1,454,875. ELECTRIC HEATER FOR SHOE MACHINERY; C. L. White, Medina, N. Y. App. filed Jan. 24, 1921. For edge-setting soles.

1,454,878. MAGNETIZABLE METER VANE; T. D. Yensen, Swissvale, Pa. App. filed June 9, 1919. Alloy of nickel and iron.

1,454,879. CONNECTION OR BINDING TERMINAL; R. Zollner, Dresden, Germany. App. filed April 6, 1921. Distribution block.

1,454,895. ELECTROLYSIS MITIGATION; G. G. Jones, New York, N. Y. App. filed Sept. 24, 1920. By raising earth potential in vicinity of trolley tracks.

1,454,925. DYNAMO-ELECTRIC MACHINE; R. E. Hellmund, Swissvale, Pa. App. filed Nov. 19, 1917. Single-phase commutator-type motor.

1,454,928. CONTROL SYSTEM; G. W. Hurtt, Wilkinsburg, Pa. App. filed Aug. 17, 1920. Automatically shunting starting resistance in series with motor armature.

1,454,943. ELECTRIC BATTERY; D. Pepper, Philadelphia, Pa. App. filed Aug. 9, 1921. Primary battery.

1,454,954 and 1,454,955. CLOCK; T. S. Casner, Plainfield, N. J. App. filed Sept. 18, 1920. Secondary clock with electromagnetic drive.

1,454,969. MOTOR; F. Hornby, Liverpool, England. App. filed April 28, 1920. Toy motor.

1,454,997. CRYSTAL DETECTOR; G. Greco and K. G. Wolff, Newark, N. J. App. filed April 18, 1922. Dust-proof holder.

1,455,001. STOP AND TURN SIGNAL; Y. Honda, Fowler, Cal. App. filed July 26, 1922. For automobiles.

1,455,054. AUTOMOBILE SIGNAL; M. G. Ivandick, North Chicago, Ill. App. filed April 18, 1922. Rear direction signal.

1,455,074. APPARATUS FOR RECORDING LIGHT; T. W. Case, Scipio, N. Y. App. filed Dec. 11, 1920. Apparatus reading in footcandles utilizes photo-electric cell.

1,455,081. INDUCTANCE COIL; E. G. Danielson, San Francisco, Cal. App. filed May 25, 1921. For radio apparatus.

1,455,099. HIGH-FREQUENCY SIGNALING SYSTEM; W. R. G. Baker, Schenectady, N. Y. App. filed Jan. 5, 1922. Radio transmitting system.

1,455,122. ELECTRIC LAMP SOCKET; C. E. Stahl, Meriden, Conn. App. filed Jan. 22, 1920. Miniature bulb socket.

1,455,139. ELECTRIC DEHYDRATOR; F. W. Harris, Los Angeles, Cal. App. filed Oct. 19, 1920. For removing water from petroleum.

1,455,141. RADIO RECEIVING APPARATUS; P. D. Lowell and F. W. Dunmore, Washington, D. C. App. filed March 27, 1922. Radio and audio frequency amplifier using alternating current on tubes.

1,455,188. METHOD OF FORMING FLAT COILS; H. G. Cox, Chicago, Ill. App. filed June 23, 1919. Making oval coils at high speed.

1,455,194. MOTOR CONTROL; J. Eaton, Schenectady, N. Y. App. filed March 15, 1921. For motors operating feed of planer or the like.

1,455,205. ELECTRIC SADIRON; R. J. Hovey, Chicago, Ill. App. filed Jan. 19, 1921.

1,455,231. MANUAL SIGNAL FOR VEHICLES; J. Spaventoy, Brooklyn, N. Y. App. filed Sept. 10, 1921.

1,455,246. ELECTRIC IMMERSION HEATER; M. C. Furstenau, Philadelphia, Pa. App. filed Dec. 10, 1921.

1,455,285. TELEPHONE INDICATOR; W. H. Eastman, Concord, N. H. App. filed June 1, 1922. Indicates whether some other party on line is using it.

1,455,287. ELECTRIC HEATER; I. L. Hadley, Hartford, Conn. App. filed Aug. 23, 1922. Bottle to be heated placed in bag lined with heating element.

1,455,344. VENT PLUG FOR STORAGE BATTERIES; L. Lyndon, New York, N. Y. App. filed Sept. 7, 1921.

1,455,375. LIGHTING FIXTURE; H. C. Adam, St. Louis, Mo. App. filed Aug. 30, 1920. Inclosed globe designed to reflect most of light downward.

1,455,399. FLUSH WALL-RECEPTACLE PLATE; W. R. Keavaney, Waterbury, Conn. App. filed March 13, 1920.

1,455,415. CONDUCTOR CONNECTION; J. T. Tighe, Scranton, Pa. App. filed Jan. 14, 1921. For trolley cross-over wires.

1,455,422. DIRECTION INDICATOR FOR MOTOR VEHICLES; S. H. Boitnott, Roanoke, Va. App. filed April 18, 1921.

1,455,458. MEANS FOR DETECTING SMALL ELECTRIC CURRENTS; J. S. E. Townsend, Oxford, England. App. filed Oct. 15, 1918.